UNISCAPE En-Route

a. I – n. 4 – 2016
ISSN 2281-3195

CSV CENTRO STUDI VITRUVIANI
UNIVERSITÀ POLITECNICA DELLE MARCHE
UNISCAPE EUROPEAN NETWORK OF UNIVERSITIES FOR THE IMPLEMENTATION OF THE EUROPEAN LANDSCAPE CONVENTION
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Summary

Archaeology, Landscapes, Contemporary Locations

Andreina Ricci

☞ Università degli Studi di Roma "Tor Vergata"

At the beginning of this conference, promising such an abundance of issues and all of great interest, and in wishing to thank Paolo Clini for so kindly inviting me here today, I feel I should clarify that I will not be making, as it were, an "institutional" reflection. Rather, I will be concentrating on certain segments, a number of unresolved questions (often conceptual, rather than normative), and I will be making a number of observations, the fruit of experience and interdisciplinary collaboration gained in many years of work in the field.
I would like to begin with the (exclusively Italian) term, "Beni culturali", which is often replaced, with no consideration for distinction, by other terms coined in other European countries. I'm referring above all to the term , typically French and the term , used in the United Kingdom and in English-speaking countries. However, these are terms which actually allude to different concepts and are in no way interchangeable. We are all indeed aware of the distance separating a , which our Constitution defines a "torchbearer of culture" (whether it is or not is a sensitive issue I will not touch upon today), and something with "monetary value" alluded to in the French term , unlike which chiefly indicates a legacy received and than left to others, which might be extended to assume multiple values, not only of a monetary nature, but also symbolic, cultural, emotional.
All these terms, with their stock of respective meanings – not only concerning the norms in force but also the lexis and choices of the experts – often get mixed up, frequently producing contradictions. A simple, yet eloquent, example of such a confusion concerns the obligation to attribute a price, when cataloguing moveable objects, to each of them, though in many cases we are dealing with tiny fragments of mass-produced objects intended for daily, domestic use, which are not even easily recognisable as ancient (training is required), and which have no other value than that of an historical source – as long as they have been identified as part of a precise stratigraphy (not binding for normative concerns).
Keeping to the sphere of archaeological heritage, one well-known aspect we should recall, because it resembles what is happening in the field of , is the extension of the term to ever more wide-ranging object categories requiring protection. A process seen in the 1970s and '80s when the controversy accompanying the inclusion of so-called material culture in the large family constituting cultural heritage, saw the deployment of opposed fronts – "field archaeologists" and "archaeologist-art historians". I recall, incidentally, that this is a typically Italian phenomenon, and this too is a source of confusion and problems. It is in fact only here that a specific preparation in the field is lacking, the same which is envisaged in many other countries, and I believe also that it is only here in Italy that ancient art history has, as it were, become one with archaeology. In any case, in the disputes of those years, the arguments sustained by different contendents nourished theoretical reflections, developing mainly in France,

where in only a short time they led to the assertion that "everything is heritage". A paradox, clearly never resolved, which fifty or so years later is still influencing the current debate about landscape.

I will come back to this shortly, but to remain a moment with the increase in the number of cultural assets requiring protection, I would like to recall that while for objects, the problem has been mostly about where to store them since they are so many, for objects the problem has been, and continues to be, decidely more complex. Archaeological remnants found all over those areas constituting a territory might in fact forge multiple links with the locations they find themselves in now. We are clearly dealing with complexities which tend to burst on to a scene, in many circumstances – and frequently; what's more, we know all about the conflicts which flare up from time to time, between tendencies pushing for transformation, and an idea of conservation at times opposed to any intervention at all.

But this is not all. Here I would like to touch upon the obviously uneasy relations between archaeological and landscape heritage. What is established between the two is a far from predictable relation, though it is often used for mutual support when someone wishes to obstruct transformation or set up archaeologicl reserves or "protected areas". However, this is often just occasional, instrumental, ephemeral, and, given the reality of ordinary administration, is often conflictual. The example of the (please forgive me if my examples are mainly Roman) is symptomatic. Based originally on just such a conjunction of events, it has suffered from a lack of equilibrium for years, a disharmony between the parts which benefits nobody, especially the public.

I would like to say briefly that with archaeological heritage and landscapes we tend to consider as that "solidarity" which does not correspond to objective facts or to an actual state of affairs. Clearly, a relation exists but it should be rethought carefully because it might result in a positive actualization only: a) in function of the meaning attribute to it today, b) with the identification, step by step, of the potential which such a relation can have in terms of: a quality which each time should be highlighted, motivated and above all (when dealing with constrictions, transformations, redevelopment, or whatever) planned in advanced.

I would like to pause a moment over the question concerning the "project", which I consider central, but not before speaking about the paths followed so far – parallel to the broadening of the concept of – which have incorporated the concept of .

A new enthusiasm, accompanied recently by inevitably conservationist tendencies, leads us, these days, to embrace an idea of landscape which is no longer easily delimitable. "Everything is landscape" we tend to hear, just as we used to hear "everything is heritage". However it is obvious that we really do need delimitations since in actual fact – and without much reasoning behind it – what we continue to hear about is the only delimitation to have emerged so far, that of so-called "historical landscapes". This is not very sound, both on a theoretical and practical level. What's the point of speaking about an historical landscape? "A landscape is either historical or it isn't", we now hear with more and more determination.

And yet this statement, which might seem trite, predictable, to some, heretical to others, is not just a provocation in that, in saying "the king is nude", a double truth is summoned up.

Trite, because it is often used superficially and reduced to a commonplace whereas in fact it is a theme of great complexity. Heretical, if we consider how much opinions about reality (not only in practices, in policies, in regulations, but also in the mindset of specialists and operators) are still far from being shared by all. Basically, the most "innovative" choices proposed are clearly not worthy of a country disseminated with archaeological remains in the midst of the most diverse of landscape-environmental contexts and which might actually lend themselves to countless solutions and experiments.
In most cases, however, we limit ourselves to juxtaposing the ancient and the contemporary in purely mechanical terms without harmonising two periods which are complex and distant one from the other. Or we think in terms of reusing buildings and archaeological complexes as , debating lengthily what types of performances are to be considered appropriate. Or even with "contrasting" ideas in mind: older locations which host contemporary works, or industrial, disused-then restored structures, factories, etc., which host sculptural remains from the Classical age. This is not a criticism per se – or perhaps it is, in that a certain satisfaction is felt concerning this limiting mortification, in comparison with the infinite possibilities we have at our disposal to explain, both on a theoretical plane and in concrete planning terms, the "contemporaneity" of surviving remains.
How then do we single out and circumscribe portions of the landscape which might deserve our attention? On which criteria should recognition of "value" be founded? I have chosen the word value carefully; it chracterises little, because I feel that we find it difficult to fix precisely upon that indefinite quality which we sense intuitively, not easily translatable into prescriptive action. In other words, the relation we are trying to establish between remains from the past and contemporary locations (in both urban and rural landscapes) has now emrged, and in recent times, to a startling extent, but this relation (ancient-contemporary), which has burst suddenly into our everyday routines, is at the mercy of dangerous, instrumental slogans which contribute to the demolition of an entire system of management of the "cultural heritage". This demolition is easier, more comforting, compared to the committment we would need to make improvements, eliminate or straighten out the many distortions – which everyone knows about, of course – which have characterised conservation for too long, weakening its authoritativeness and credibility.
Leaving aside predictions and evaluations, I am convinced that a direction exists, at the centre of our objectives consisting precisely the role which conservation should and could carry out in the application of to ancient locations and contexts, a central theme left suspended above. It is planning which should highlight, recover, suggest which quality contexts should have; without it these contexts are circumscribable only with great difficulty (be they ancient contexts or landscapes). Furthermore, the elements which allow us to attribute quality to a location are in many cases variable, perceptible intuitively rather than mechanically registrable; they are difficult to list and establish once and for all. It is rather the outcome of combinations, random too, which have to be discovered-recognised, highlighted, explained, each time and then, in a word, planned: both with areas already considered of value, and of spaces to be redeveloped, and locations in which it is necessary to a quality to project into the future.

The quality which derives from the project does not disavow and does not substitute the norms in force, but – in a way – runs parallel to them, and it plays an essential role. Moreover, we know very well that "regulatory" intervention does not guarantee quality. It is rather the variables brought to bear by the project which usually guarantee the committment. What do we mean by this? When we speak of planning, engineers, developers, environmentalists, landcapers, all those who meet, or clash with, the archaeological heritage, are thinking of something which, within each skill, has its own characteristics, rules, objectives, precise paths. But when we archaeologists arrive on the scene, this is not the case. Our role is generally less active – and thus less effective – than what it could be if we went beyond the excavation, or according to which role is meant, beyond the mere verification of regulatory application..
I am convinced that what has been, and continues to be entirly lacking, is just such specific planning, not but , of the archaeologists on archaeology itself. The responsibilities of archaeologists seem depleted – and for too long, they have lacked an active role – made up of prohibitions or prescriptions, bordering on other skills (from urban decoration to greenery: flower beds, walls, gates, fences, illumination). I do not wish to trivialise this work of conservation and research (I include all us archaeologists too, not only the bureaucrats in charge of conservation) which in the last 60 years, in many ways, has been of great value. I would simply like to submit a decisive critique of its all-too-often shortsightedness in planning policies which should today, in my opinion, be overcome to allow a reorientation, above all in two directions: the first concerns the areas already excavated and abandoned, which often, in our urban landscape, seem wounds, incomprehensible, never healed; the second concerns the new landcapes to "construct" and leave to the future.
The first planning initiative therefore should concern how to understand non-expressed potentialities at the end of an archaeological dig. A theme effectively condensed into a nice passage by Louis bertrand, in 1927, on the evils of archaeologists.
All this is plainly to be seen by all those who – just about everywhere – happen to come across the many areas in our country, excavated and abandoned, even the most famous. Concerning many of these situations, it is difficult not to arrive at a question I will leave open to discussion: why today? – given these imcomprehensible skeletons, as it were, which do not allow us to share history or memories? Why I repeat, around these "new ruins" manufactured" by archaeologists, do crowds gather who understand – who are able to understand – nothing? Are we not at fault in this process, above all we, as achaeologists (as individuals with special skills); are we not responsibile for a cultural "dumbing down", with respect to how those remains might usefully and more effctively tell a story?
So an should/might emerge in the course of the excavation, with a far-reaching idea about the restitution of the area to the public and the multiple possibilities that historical research offers, besides the responsibility which the archaeological anomaly brings, once the re-attribution of value to locations to be restituted to public use is understood. And this should be the most important and significant component of the work of an archaeologist who, at the end of the excavation, might find satisfaction, having truly fuflfilled his professional tasks, if the remains left in the field are subject to three planning initiatives which our discipline should be

called upon to enact. Three moments which actually shape the project: a) the of the results of the research (a destination not always reached, meaning general descriptions dominate); b) that of the translation of the results, which makes possible a re-signification and the establishment of a relation between the otherness of the ruins and those who observe them; c) the moment of the proposal (or proposals) for a narration which uses achaeological remains as a source and as illustrative materials at the same time.

To progress from work on the areas already excavated and abandoned (which requires a "sewing up" operation linking past and present) to the second planning direction which concerns the creation of quality in our landscapes, I need to cite a case in which I am personally involved. I'm referring to a small museum, inaugurated a year and a half ago, at the university of Tor Vergata, in the furthest suburbs of the city. It's name, (Museo apr.it), and even more, what follows, indicate the need to plan a new way of looking at urban archaeology and Roman archaeology in particular.

In the first room, indeed, like a visiting card, the "archaeological project" is illustrated; it deals with the theme of the centre-suburbs relation, and suggests solutions on different planes (inter-municipal, area, groups of buildings or other structures) aimed at retreiving, and attributing sense to, myriads of scattered archaelogical fragments. In other words: retrieve this archaeological sprawl with all those most degraded parts to be found in a city like Rome, whose suburbs (90% of the urban surface) require urgent redevelopment – also by means of interventions of this type.

In the suggestions on display, also the *criteria* followed are illustrated, the choices made, the technologies employed (strictly in relation to the messages to be transmitted, as it were) and above all the objective: going beyond the limiting (and from a certain viewpoint mistaken) idea of historical centre, to that of historical city; a transition we need to establish a more interesting and culturally active relation with the public, and then to suggest a rethinking of how tourism should be handled.

On display in that first room are planning hints and aims which, I feel, the archaeologist should bring as a dowry, as it were, to that encounter-meeting which is a determining factor in the themes we are dealing with, and which goes under the name co-planning. A dialogue with multiple voices, indispensable if we wish to produce solutions to complex realities like those at hand, and whose use should expand, both to re-attribute sense, dignity, liveability to degraded areas, and also to help face up to the complexity of landscapes so that we can construct for the future – to which to entrust what our era considers beautiful, enjoyable, interesting, knowable, re-knowable.

Once this bridge has been crossed, between the first and second area of interest towards which our planning efforts should be oriented, we cannot fail to mention, though briefly, the role played – or rather which should have/could have been played – by so-called.

The theme (which appears also in the programme of this conference) is, as we know, rather delicate, controversial; it has never arrived at a fixed, shared point. It enters, leaves, is modified, flees and re-emerges in and from the place where it tends to be expressed; it should be obvious that I am referring to , especially the new . It is common knowledge that the main aim of a

preventive archaeological study should consist (the use of the conditional here is deliberate) in avoiding the short circuit (very frequent in a country like ours) between new works and unexpected finds of buried remains: a conflict which, as we know, is always damaging both for transformation projects and for the correct conservation of heritage.
As for objectives and procedures, the situation in recent years has been extremely confused; even after 2005, when this theme took on a particular relevance precisely because it entered the sphere of Public Works regulations, an important development, which, however, was only the first step in a procedure still largely to be followed up. Indeed, in recent years, though attracting attention, gaining consensus and benefitting from committment, preventive archaeology has been interpreted and set out in many different ways and as far as I am concernied, often mistakenly, by many of those who work in this sector.
For example is has been used: a) as an opportunity to experiment with particular technologies (independently of their appropriateness, whether suitable or not for particular territorial areas of interest, or the real objectives behind this type of study, b) as an opportunity (on the part of archaeologists and bureaucrats) to use the resources of backers to simply excavate as much as possible, c) as an occasion to train new archaeologists. However, the result has been to create a grey area, dangerously ambiguous, between the use of professionals and the use of students in works which were initiated, apparently, with didactic aims in mind.
These and many other interpretations of preventive archaeology, confused, mixed together, have led to an extremely disorienting framework, bordering on illegality, which we are paying for with a generalised refusal to intervene
From the experience I have accumulated in so many years dedicated to this type of work (on small but also large public works) I have come to the conclusion that this confused situation can be improved upon (as long as there is the political will and the skills to take on the challenge) by retrieving the priority of the original objectives, some of which, over time, have been lost.
The first concerns a theme both important and (usually) ignored (indeed, used in the opposite sense) and it is essential that we recall and retrieve it.
These are the recomendations published by UNESCO as long ago as 1956, taken up again by the Commissione Franceschini 1960 and again in the Malta Convention, about twenty years ago, which highlighted the need to excavate as little as possible so as to conserve sediments, contexts, stratigraphies for study by future generations. An inverted tendency which it would be extremely important to retrieve after decades in which every occasion has been exploited, to excavate, just about anything, always, and everywhere.

From this objective others emerge. The singling out of areas of greatest risk of impacting buried, non-visible remains which cannot be left to a single tool, but should start off with the n of the whole stock of information available (and there is a great deal – and everywhere) and the use of a lot of technology (which can always be perfected, but in any case which is already effective and in widespread use) which allows us to organise and interrogate this despite the heterogeneity of the information. I feel that this theme, which truly involves all

the professional skills we have encountered over decades in the work in the field, should in the near future be given more space, above all in a moment like this, when our conservation system would seem (it is not entirely clear to me) to be weakening (or seems not to consider a priority) the capillary nature of territorial intervention.
There are many issues of great interest planned for this meeting and I am certain that this occasion will lead to further in-depth work and further debates. As for me, I am aware that I have been describing what amounts to a rather bumpy ride up to now, from the questionable shift in sense concerning current definitions and languages, to the not necessarily easy cohabitation in the Archaeology-Landscape "marriage". From the difficulties of circumscribing portions of landscape to which sense and value have to be recognised, re-attributed (or even attributed), to the new and greater responsibility to entrust to co-planning in which finally a voice will be found for that project which archaeologists should begin drawing up, concerning what remains of their excavation work. As for the two areas of interest we should be more concerned with, of particular importance is now the re-attribution of significance to those "open wounds" in our cities, and the creation of "new landscapes".
Those who have been working for some time on this cluster of themes know full well that we are dealing with key aspects which policy-makers find difficult to grasp. But I am also convinced that they are issues of great importance for locations and the protection of their history.
In the production of or , which each era has shaped in its own way, it is essential that the one we are discussing here today takes place in the light of a "quality" to be redefined and planned. Back in 1981 Giovanni Urbani stated that, once restored to the environmental system, so-called cultural heritage cannot be assigned a function and position unlike that which touches upon every other component of the environment, or which becomes an unbending resourse for a policy of development aiming at re-establishing a certain equilibrium between socio-economic and environmental issues. This is a point of departure allowing us to pass from a quantitative society to a qualitative one. And this might just mean another conference! We certainly need one and with the full participation of the many skills and specialisations represented here today.
While awaiting this, I would like to wish you all the best on the work at hand.

Smart Landscapes

The use of ICT in Public Open Spaces: some insights.

Carlos Smaniotto Costa[a], Ina Šuklje Erjavec[b], Roberto Pierdicca[c]*, Eva Savina Malinverni[d], Anna Khromova[d], Andrea Galli[e], Ernesto Marcheggiani[ef]

[a]Universidade Lusófona, CeiED Interdisciplinary Research Centre for Education and Development, Lisbon, Portugal (smaniotto.costa@ulusofona.pt)
[b]Urban Planning Institute of the Republic of Slovenia, Ljubljana, Slovenia (inas@uirs.si)
[c]Università Politecnica delle Marche, Dipartimento di Ingegneria dell'Informazione (r.pierdicca@univpm.it)
[d]Università Politecnica delle Marche, Dipartimento di Ingegneria Civile, Edile e dell' Architettura (e.s.malinverni,@univpm.it; ann02_86@mail.ru)
[e]Università Politecnica delle Marche, Dipartimento di Ingegneria Civile, Edile e dell' Architettura Università Politecnica delle Marche, Dipartimento di Scienze Agrarie, Alimentari ed Ambientali (e.marcheggiani, e.galli@univpm.it)
[f]Department of Earth and Environmental Research, KU Leuven

KEYWORDS: Public Open Spaces, ICT, cyberpark, Mediated Spaces, Urban and Landscape Planning, Societal challenges

Introduction

Today, more than half of world population lives in urban areas (United Nations, 2012). The quality of human life largely depends on quality of urban environment. To improve the quality level of urban spaces the goal to reach a right balance between "grey" and "green" components is a very important starting point. Moreover, considering that people make use today of technology in everyday life for almost every task, we have to consider how new Information and Communication Technologies (ICTs) can help us to face this challenge [Vukmirovic, M et. al, 2014]. Actually, ICTs can improve the quality of public open spaces since their contribution is twofold: from one hand, they provide users with new instruments to enhance their experience of visiting and discovering a place. On the other hand, they represent a priceless source of information that should be used by planners in the planning process. From these considerations arise the concept of "Cyber-Park", which refers to outdoor public places, where the use of ICTs creates a synergy between humans and the environment [Elke Geratz, 2013]. It is worthwhile to underline that the ICTs are not just as an "added" component of current management of public spaces, but they rather represent a boost for planners on the way of a more creative and inclusive designing process. It is very useful to include ICT tools from the beginning of design process, when analyzing urban areas and needs of inhabitants, in order to help a useful data and information collection.

The Cost Project "Cyber-Parks"

Under the COST-Framework, the "CyberParks" project – Fostering knowledge about the relationship between Information and Communication Technologies and Public Spaces- has been developed from June 2014 involving a network of 70 experts from different working fields and scientific domains, coming from 29 different European countries. The project goals are sharing knowledge and experiences for disseminating the outcomes coming from the five trans-disciplinary Working Groups (WG): Digital Methods, Urban Ethnography, Conceptual Reflection, Creating Cyber-Parks, Networking and Dissemination. The last WG works as a think-tank and is in charge of organising the knowledge transfer, the young experts' platform, the formulation of research perspectives and follow-ups. In the following, will be briefly discussed some crucial points in relation with the used of ICT tools in urban green parks from the point of view of planners (designers) and users.

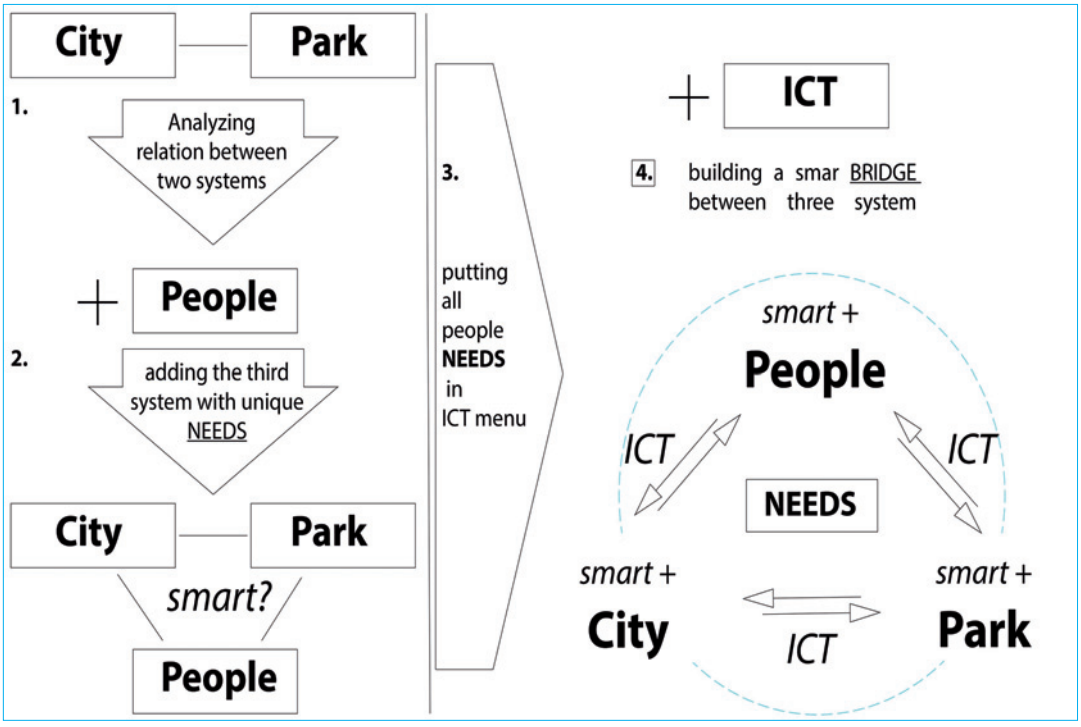

Fig. 1. The main components of the system and their relation with a smart environment

Theoretical and Practical Perspectives

Urban open spaces are complex systems of different components like buildings, trees, roads, facilities networks, people, monuments, etc. They take a part in three main domains: Nature, Culture and «Geist» which indicates the "Spirit" defining human goals and lines of action

to change the nature, guided by the culture [Dobrohotov, 2010]. Nowadays is common to use the non-classic approach as the methods of design, as defined by a Russian philosopher [Stepin, 2009]. The planners aim to create harmony with Nature by considering needs of all components of the system (Fig. 1). Interaction between planners and users is based on continuous dialogue. Conversely, adopting the post non-classic approach [Prigogine, 1977], planners aim to promote synergy between Nature and Culture, giving only the direction (guideline) of any possible ways of development of the system, considered as a whole. This post non-classic appears the most suitable model for cyber-parks, in this framework ICT tools take a main part in all process of design as well of enjoy parks by users. Today there are plenty of ICT solutions to optimize, diversify and facilitate the usage of city parks by users. We can identify 3 subgroups of users: tourists, residents and researchers, each of one having different needs. ICT solutions addressing these needs may be divided into 4 groups: Basic (security, navigation, access control, monitoring, positioning, etc.), Emotional (installations, lighting scenarios, music, etc.), Cultural and Spiritual (Integration with social networks, mobile apps with place/event/driven, smart furniture, etc.), Rational (WiFi, charging stations, educational games, workshops, virtual tours, etc.). These solutions are not only for skilled professionals (i.e. landscape architects, urban designers) able to accept the challenge to draw up convincing ideas and inclusive spaces, but also politicians to prioritize the inclusion of quality public spaces in the urban agenda. The challenge is how to make use of ICT to make urban open spaces even more public and inclusive and to attract more people to live a healthier way of life. New technologies will probably induce the creation of public spaces 2.0; the increasing vitality in our world will not affect the real architecture, but should increase the ability to propel the cultural narrative. The central challenge remains how to use digital technologies to transform our cities into interactive landscapes and urban places, encouraging involvement and better social environments, supporting sustainability, responsibility, and knowledge about nature, people, and the city.

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Resiliency Units. Circular Metabolisms in Urban Areas. The Case of Colombes, Paris.

Dario Aureli

☞ Dept. Architecture, University of Roma Tre, Italy – dario.aureli@gmail.com

✔ KEYWORDS: *resilience, urban areas, urban metabolism, urban regeneration.*

ABSTRACT

In 2008 begins R-URBAN, a project developed by Constantin Petcou and Doina Petrescu, Atelier d'Architecture Autogérée. A Colombes, a suburb north of Paris with more than 80,000 inhabitants, thanks to the involvement of citizens and neighborhood associations, they decide to turn an 'abandoned area of about 3,500 square meters in the first nucleus of what they themselves define as "urban resilience units ". The intent is to create a micro-urban metabolism closed on the basis of Andre Gorz motto, "producing what we consume and consume what we produce."

The project is based on a series of bottom-up strategies that will allow residents to change their lifestyle and develop "resilient activities", reducing the intake of outside resources and reducing waste.

R-URBAN project, is certainly the fruit of that popular movement of opinion that based on the experiences of New Yorkers Community Gardens, and different active urban programs in various cities, from Paris to London to Berlin, it is bringing to light a new way of understanding the relationship between life in urban areas and agricultural activities and cultivation.

In this panorama, R-URBAN, "Resilience Unit" which has the ambition to start from small scale and finally reaches the large urban scale, can affect not only the social, environmental and food aspects of the daily life of citizens involved, but also the economic side, labor and energy, creating in its own way the "third way" conceived by Howard already at the beginning of the last century.

Beyond sustainability

ECObox was created in 2001 as a garden, but also as a meeting place where different cultures and social classes could come together. Dozens of people, including residents, architects, artists, researchers, students and teachers occupied the urban void around the Rue Pajol railway station in the Chapelle district of Paris.

Under the direction of two young Romanian architects, Constantin Petcou and Doina Petrescu, Atelier d'Architecture Autogérée designed and built a temporary garden on the paving in front of the train station. The construction of the garden used inexpensive, readily available materials like wooden shipping pallets, landfill from nearby construction sites, straw, plastic bottles for drainage, and of course hammers and nails. With the help of local residents involved in the project, the garden soon became a symbolic site for the diverse neighbourhood communities.

The aim of the initiative was to trigger the creation of an Eco-urban network by taking over unused spaces and abandoned lots. The temporary garden consists of light weight transportable equipment, including a mobile-kitchen and moveable tool shed and workbench. The goal

was to be able to move equipment from one place to another, creating a series of transitional architectural spaces, suggesting possible future uses for the neighbourhood's abandoned areas.
ECObox suggests the many possibilities of transforming urban space. Constantin Petcou and Doina Petrescu wanted ECObox to be seen as a generator of urbanity. While it functioned ECObox was a meeting place for children, a place of shared understanding for adults, a language garden, an outdoor cinema, and a site for residents to hold parties, ceremonies, even weddings (Aureli 2011).
In 2008 Constantin Petcou and Doina Petrescu created a new project: R-URBAN. The project in Colombes, a Paris suburb with over 80,000 inhabitants, involved both residents and neighbourhood associations, and turned an abandoned area of approximately 3,500 square meters into the nucleus of what the architects define as "urban resilience units". The intent was to create a closed micro-urban organism on the basis of the Andre Gorz moto: 'produce what we consume and consume what we produce'.
The project is based on a series of networked strategies on different scales: street, block, and neighbourhood, allowing residents to change their lifestyle and develop "resilient activities" while reducing the need for outside resources and producing less waste.
From 2008 to 2015, with the support of local authorities and in cooperation with various partners, the R-URBAN project obtained European (Life +) and state funding of about 1.5 million euro. The resources were used to build Agrocité, an experimental farm with community gardens, composting stations, a rainwater recycling system, energy producing devices, and educational spaces. The RECYCLAB equipment recycles waste and turns out material for green building.
Thanks to R-URBAN, several hundred citizens regularly take part in gardening activities, beekeeping, or teaching composting, recycling and Eco-design; the project employs a dozen people either on a permanent or temporary basis.
Both ECObox and R-URBAN are definitive, tangible results of the widespread movement to promote a better understanding of the relationship between life in the city and agricultural activities and crop cultivation. The movement has its roots in 1960s criticism of modernism's inability to deal with urban spaces (Jacobs in 1961, Chermayeff and Alexander in 1968, as well as Ghel in 1991, and Davis in 1999), and was inspired by the New York Community Gardens that started in the 1970s and which have changed the geography of Manhattan's urban spaces.
Though created out of the same cultural milieu, the two enterprises have a marked difference in their definitions of the concept of ecological resilience, as described by Crawford Stanley Holling in 1973.
In 1973, Holling, Professor in Ecological Sciences at the University of Florida, wrote a seminal article on the concept of resilience in ecology entitled "Resilience and stability of ecological systems". Holling uses the two terms, resilience and stability, to distinguish two key ecological concepts: the ability of an organism to find its own balance in foreseeable environmental conditions (stability) and the ability of an organism to find new balance in unpredictable environmental conditions (resilience).
For Holling, the concept of resilience, referring to an organism or ecosystem, is related to an ability to withstand changes in external conditions or shocks of any nature, remaining alive,

even if in a reduced or different manner. Stability indicates the ability of an organism to live efficiently, adapting to environmental conditions in which changes are slow or predictable.
This same marked difference is considered and amplified by Michael Mehaffy and Nikos A. Salingaros in a series of short online essays, "Toward Resilient Architectures". The authors identify four parameters that mark the difference between a resilient system and a non-resilient one, albeit efficient and/or sustainable. The parameters, which also apply to urban systems and architecture, include an interconnected network structure; diversity and redundancy (a distinct notion of "efficiency"); wide distribution of structures in scale, including fine-grained; and the capacity to self-adapt and "self-organise".
Analysing the 2001 and 2008 ECObox and R-URBAN experiences, the same differences that distinguish sustainable and efficient systems (an organisation or project) emerges, compared to one that is also resilient.
Unlike ECObox, R-URBAN seems to fully adhere to the parameters identified by Mehaffy and Salingaros, especially regarding the variety of scale and dimension, interconnections and redundancy. The 2008 project clearly demonstrates an ambition to start at a small scale and proceed to a larger urban scale, and a willingness to produce different kinds of structures that could be considered out of place in urban areas.
In addition, the ability to adapt and self-organise is inherent in the very genesis of a project which aims to create a circular system of urban metabolism. A circular metabolism has its own life, or nearly so, and is thus better able to absorb external shocks. Linear metabolisms, instead, also virtuous and sustainable, receive and transform outside resources, and are therefore heavily influenced by external events and lack an ability to readjust and reorganise.

R-Urban

"R-Urban is an 'R' word. It relates directly to the three 'R' imperatives discussed in ecological approaches to urban territories – Reduce, Reuse, Recycle – and suggests other iterations: Repair, Re-design, Re-think, Re-assemble etc. In addition, the term indicates explicitly that R-Urban reconnects the urban with the rural through new kinds of relations which are more complementary and less hierarchical. The 'R' of R-Urban is a reminder also that the main goal of the strategy is 'resilience'" (Petcou and Petrescu, 2012)
It is no coincidence that the "R" in R-URBAN expresses the concept of resilience. Creating "resiliency units" not only affects social and environmental conditions, as well as making the growing of food part of residents's daily lives, but also has a bearing on economic aspects, employment, and energy efficiency.
Going beyond sustainability, R-URBAN is the expression of a new element in the debate on urban renewal. Going back to the categories defined by Holling, sustainability expresses the ability of a system to be efficient and viable in conditions of stability. But sustainability does not always expresses a system's capacity to stay alive in times of stress or exceptional and unforeseen situations. This capacity, expressed by the term resilience, incorporates and expands the concept of sustainability.

According to Karin Bradley and Johan Hedrén, going beyond sustainability, often expressed as ecological modernization, and the importance that the term resilience has taken on in recent years, is not coincidental. In their book *Green Utopianism*, they illustrate how resilience represents the most appropriate response to a loss of confidence in the major international climate agreements (Rio 2002, Johannesburg 1992) which are struggling to make effective progress. Resilience also represents the most immediate response to the growing feeling of insecurity generated by the economic crisis and natural phenomena such as hurricanes, tsunamis and earthquakes (increased by the ease of access to vast databases of images and videos).
The mistrust and insecurity have led to a desire to act personally in transforming the environment into a more sustainable organism, one better able to respond to new stresses. Over the past decade this has produced an increasing number of initiatives; the most well-known being Rob Hopkins's Transition Town which invites citizens to commit themselves to transition without waiting for others to instigate change.
In accepting the invitation, R-URBAN, as expressly stated by Costantin Petcou and Doina Petrescu on several occasions, combined it with an ambition to create a new way of city living. A way of life linked to the traditions of great green utopias like Howard's Garden City and Geddes's Regional City but more closely connected to the realities of contemporary cities; to take concrete action using a bottom-up approach to urban regeneration. The idea is to combine the utopian ideals with a capacity for action within the context of new sustainable ecological movements and shifting opinions; not to create new utopias, but experimental realities. Building these living, vital workshops produces new ways of interpreting urban life, capable of responding to external forces, be they cultural, economic, demographic or environmental.

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Conservation and Management of Landscape as Protection and Enhancement

Emanuela Farano

☞ Ministero dei Beni e delle attività culturali e del Turismo. Roma. emanuela.farano@gmail.com

✔ KEYWORDS: protection, enhancement, participation, local resource.

ABSTRACT

The management and preservation of landscape in Italy is linked to the concept of protection and enhancement. The first laws that address the issue landscape date back to 1939 (L. 1089 and L. 1497). Two laws which, although partly ineffective, however, initiate a virtuous change process through the introduction of landscape planning. In the 70 debate regarding landscape issues is lively, starting the overcoming of the concept of "natural beauty" process. But it is only after 1998 that the "landscape" enter the name of the Ministry of Cultural and Environmental Heritage.

The real change in Italian legislation, however, takes place in 2004, when the Code of Cultural Heritage and Landscape, changes the same object of protection, on the basis of the European Landscape Convention ratified in Florence in 2000. The landscape is defined as a part of the territory as perceived by people, the fruit of the natural and human, and their interrelations.

The concept of protection and management thus takes on a broader meaning: the protection is aimed at the preservation of the landscape values, which are therefore not only related to natural elements (morphological, hydrogeology, nature) but also to the historical, social, productive, giving their identity in a territory. The new concept of landscape is received by the 2004 Code, which introduces new assessment tools in the management and conservation of the landscape.

The art. 135 provides for the extension of the landscape plans of the whole region which is divided into landscape areas identified by common characters, They define the objectives of protecting the risk factors and the requirements to follow. Observers will monitor the landscape so that the quality is guaranteed landscaping both conservation and the construction of new landscapes.

Even the concept of conservation of a landscape takes on the meaning of active protection, enhancement and promotion of the identity features of the landscape; it becomes the result of a dynamic process where the population living it is the main actor. The participation of the citizen as a landscape construction tool that becomes a local resource.

Protection in Italy

In the recent past, in Italy as well as throughout Europe, landscape research has intensified, addressing issues of management and the preserving landscape heritage by expanding the scope of study to degraded and low quality areas.

Very likely the renewed interest has its roots in a heightened sensibility to the quality and welfare of the places we inhabit; uncontrolled territorial transformation over the last century has changed the layout of the land and drawn attention to the field of landscape protection. The European Landscape Convention, ratified in Florence in 2000, can be seen as the culmination of a cultural process marked by debate and research, but also as the starting point for a new path of growth.

Landscape management and conservation in Italy is linked to concepts of protection and enhancement. The first laws that addressed the issue date to 1939: No. 1089 for "the protection of all things of artistic and historical interest" and No. 1497 for the "protection of natural beauty". The first law concerns and is binding on all heritage, immovable and movable, of historical or archaeological value, including villas, parks, and gardens. The law also includes areas around protected sites, establishing respect for the setting, exposure and view corridors. The second law protects sites of natural and scenic beauty regarded as picturesque and the panoramic observation points overlooking such areas. These laws, despite being partially ineffective, particularly in terms of restrictions and time frames, nonetheless initiated a principled change of policy and introduced the concept landscape planning.

While from a legislative point of view no further laws were enacted until the 1970s, starting in the 1950s the lively cultural debate on landscape issues included the concept of "natural beauty". The Ministry of Cultural and Environmental Heritage was established in 1975, bringing ministerial oversight to the professional skills involved in protecting and enhancing the country's cultural and environmental heritage. Only after 1998 was the term "Landscape" included in the Ministry's name. The so-called Galasso law, No. 431 from 1985, expanded landscape protection; along with natural beauty, the law is binding on entire portions of territory, including river banks, lakesides, and all "areas protected by law" according to Article 142 appended to the Code of Culture.

The real change in Italian legislation, however, took place in 2004, when the Code of Cultural Heritage and Landscape (Legislative Decree 42/04), while acknowledging and expanding the areas of protection and existing constraints (Art. 142), made changes based on the European Landscape Convention. Landscape is declared a recognised cultural asset while its protection and conservation is governed by the third part of the code. In addition, Article 9 of the Italian Constitution now states: "The Republic promotes the development of culture and scientific and technical research, protecting the nation's landscape, historic, and artistic heritage". Article 1 of the European Landscape Convention defines landscape as "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors". The concept of protection and management in the code thus takes on a broader meaning: protection is aimed at preserving landscape values, not only related to natural aspects (morphology, hydrogeology, etc.) but also historic, social, and productive factors contributing to territorial identity, thus highlighting the multidisciplinary character of the entire field.

This concept of landscape has been implemented largely through new assessment tools for landscape management and conservation introduced by the 2004 Code. An important innovation was the introduction of three-dimensional landscape readings to produce more accurate assessments regarding the compatibility of new projects within a considered territory. Article 146 of Decree 42/2004 provides that requests for authorisations contain a Landscape Report (defined in Prime Ministerial Decree of 12/12/2005), obligatory illustrations, and an evaluation of the proposed project which emphasises the importance of the site's three dimensionality and visual perception in protecting or proposing changes to a given territory. Cartographic

and two- dimensional representation no longer suffices to fully understand changes resulting from the insertion and installation of a new project. Three-dimensional images and renderings provide a more complete assessment, allowing an understanding of a project's compatibility with landscape values, landscape quality criteria, and principles of land management. Authorisation applications submitted to the Office of Superintendencies require detailed information regarding mitigation projects to ensure the creation of suitable landscapes around new architectural projects. The code also strengthens the role of landscape design as an instrument in governing landscape, balancing the input of various institutional and non-institutional stakeholders by expanding the areas of expertise involved in landscape planning.
Article 135 provides for landscape plans to extend over an entire region, divided into homogeneous landscape areas and recognisable by common characteristics, as well as setting out objectives, risk factors and requirements. All landscapes must be defined, protected and planned, cultural and historic as well as degraded and poor quality landscapes. The study and analysis of the territory are indispensable tools in landscape planning. The code of cultural heritage, as per the European Landscape Convention, established the Landscape Observatory to study and control landscapes.

The perceived landscape and landscape conservation

To understand the meaning of the term "conservation" as it pertains to the field of landscape, one cannot ignore either the concept of spatial perception or the concept of historic time.
If we look at the meaning of the term, to conserve means to keep something, preserve it from corruption, even to cherish and *give continuity to something*. The act of conserving then, of ensuring continuity, needn't exclude changing or modifying elements constituting a landscape. Instead we can consider its transformation, admitting the convertibility of a territory while maintaining identity and integrity in landscape, Italian agricultural landscapes for example, and continuity with the past. Such changes must respect a site's historic values and characteristics, qualities Eugenio Turri (1998) refers to as layers and occurring over a "period of long time".
Vision, the act of visual perception, collects information about our surroundings, gaining knowledge of place through the cognitive, interpretative processing of elements observed and fostering a conscious approach to landscape. American landscape architect Charles Morris (1963) reminds us: "Watching the landscape is never mere contemplation, but a highly selective process in which the actor collects indications on how, in his relationship with the world, he must act to meet needs or interests." So the first step in gathering knowledge is observing the territory, be it urban or countryside; later distinctive characteristics are highlighted, along with established relationships with the surroundings, before proceeding with interpreting and evaluating the collected data. This cognitive action is also linked to the ability to connect themes and spaces observed with experiences and places visited (see K. Lynch 1996 and E. Turri 2004). Observing a landscape considers all its distinctive signs; as well as encompassing the history and memory of landscape, described as *iconemi* by geographer

Eugenio Turri, we place them within a specific historic period and attribute meaning according to our own knowledge and experience. This is a logical process; the instinctive aspects of visual perception are the product of subjective interpretations of reality. Time therefore is an essential factor in understanding landscape: the place we see today is the product of a process of stratification over time; in some cases the perception of interwoven elements linking the natural to the manmade.

Landscape is therefore the result of a process that occurs over long periods of time, historic time, and recognisable as "the visible and invisible fabric" (Eugenio Turri 1998). There are tangible territorial elements; lines of trees, medieval towers, hilltops, and intangible elements deduced through individual interpretations based on prior knowledge and experience. The men who plowed the fields and cultivated the land, who built bridges and castles, left their mark on the territory over time and their presence is reflected in nature. Ambrogio Lorenzetti's fresco (1337) *The Allegory of Good Government* is significant in that it highlights the liveliness of the landscape represented: men working, fields plowed, animals moving from countryside to city, against a backdrop of medieval castles. Time then is inherent in landscape interpretation. The landscape I see today doesn't correspond to ten years ago, neither will it be what my children will see tomorrow. Landscape is dynamic, constantly changing; you can't freeze frame it, only guide its transformation. According to Eugenio Turri, "An architect will be a much better architect when able to closely observe a site, gaining a sense of the landscape where the project is located, interpreting the underlying territorial order, and understanding the historical, geographical and social dimensions of the landscape itself." Regarding landscape even the concept of conservation takes on a broader meaning, one of active protection, the enhancement and promotion of identifying landscape characteristics understood as the result of a dynamic process where the population is the main actor. The participation of citizens in the construction of a landscape can become a resource. Actions promoting a territory's sustainable growth, triggering a virtuous approach to development, include the coordination of economic policies at both local and European levels, international promotional policies, both energy related and cultural. In this sense landscape planning can become an overarching administrative instrument, balancing needs and requirements; European policies have been moving in this direction for some time.

The Autonomous Province of Bolzano allocated part of its European economic resources for the years 2014-2020 to support dairy farmers in mountainous areas constrained by their distance from markets to spend large sums on delivery. Economically it may seem a small measure but the symbolic significance is important; not only providing stimulus for milk production in mountainous areas but other activities related to the territory as well, and preserving the environment and life and in places where productive activity is strongly linked to local culture and an identity that would be otherwise lost.

Landscape, then, understood as an available resource, can counteract over development by creating greater awareness and disseminating information regarding good practices, as provided for in Article 144 of the Cultural Heritage Code. Also established is civic participation, involving residents and associations. Educational initiatives and campaigns to promote aware-

ness sponsored by The Ministry of Cultural Heritage and Activities and Tourism (MIBACT) are also significant, as is the Italian candidacy for the 2014-2015 Landscape Award of the Council of Europe and the promotion of a National Landscape Day.

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The Design of the Peri-Urban Settlement Context

Giuseppe Caridi

☞ PAU, Dept. of Heritage Architecture City Planning, Mediterranean University of Reggio Calabria, Italy – giuseppe.caridi@alice.it

✔ KEYWORDS: City, Countryside, Peri-urban, Settlement contexts, City planning practices.

ABSTRACT

The objective of this essay is to reflect, with an exploratory and conjectural attitude, on the spatial and social dimensions of the peri-urban settlement context, positioning itself from the point of view of design understood as "professional practice" which is creative and generates knowledge (Schön 1993). The peri-urban, as Mariavaleria Mininni (2012) claimed, is not so much a determinable topographic space as an abstraction that defines a characteristic design and relation of space. It is from this point of view that it can become a formidable laboratory of ideas and practices in which the transformations of the settlement and of the residual forms of agricultural space bear the mark of the criticality typical of the current era, but at the same time are the most dynamic and vital. It is this condition of contemporaneity that the designer must watch, clearly assuming their own point of view and orientating their own actions accordingly.

Neither city nor countryside

In 2008, the population living in urban areas exceeded that of rural areas for the first time (Davis, 2006). This urbanisation continues to increase without interruption. In 2014 it was estimated that 54% of the world's population (3.9 billion) lived in urban areas; a dizzying growth if we think that in 1950 only 30% of the world population lived in cities. The percentage even rises to 66% (6.3 billion) if we refer to projections for 2050 (UN/DESA 2015).

The city grows, and the more the nerve system of the metropolitan network dilates, the more it devours its surrounding territory, the more its spirit seems to lose itself; the more powerful it becomes, the less it seems able to order-rationalise the life that takes place there, until it suffers a kind of spatial crisis: "the power that determines the metropolitan growth increasingly struggles to territorialise itself, to incarnate itself in a territorial order, to give life to forms of coexistence that are readable-observable on the territory, spatially" (Cacciari 2004). This development conditions any element extraneous to the city, which is seen as an obstacle to overcome, an unnecessary ballast, a vestige of the past, spiritualised and hallmarked.

The city spreads, "overflowing" from its borders, and runs to the countryside: "the city is everywhere, therefore there is no longer a city" (Cacciari 2004); a similar process is bound to exacerbate the contradictions within a city that becomes less and less urban, and a countryside that, meanwhile, becomes increasingly urbanised (Mininni 2005). Powerful processes of revision of the traditional forms of urbanisation will leave behind the "city" and the "countryside" as we have known them and are used to describe them, both as spatial and social facts (Balducci 2000). In the two "traditional" contexts, the urban and the agricultural, the practices and places of life evolve themselves, determining multiple innovative forms of appropriation of the space;

the paradigm of the "planned city" becomes blurred, and tends to be replaced by uncertain dynamics, weakly governed, random in many ways (De Certeau 1990). It thus affirms a manifold territory, constituted by a collection of juxtaposed pieces, the outcome of diversifying spatial-temporal stories, irreducible the one to the other (Deleuze 1987). Concepts, space, and agro-urban values confuse themselves and mix arbitrarily, giving life to a territory of uncertainty, inhabited by the "peri-urban society" (Donadieu 2006), in daily life as indifferent to the city as it is to the countryside. As we have said, the central node of the dynamics is the progressive loss of the sense of the urban/agricultural definition, just as the binomial city/countryside. This derives from the conspicuous extension of the settlement in contexts that were at one time definable as "agricultural"; this dynamic has progressively modified the constituent characteristics, so that there no longer exists merely an urban context and an agricultural context, but also a context that is "other". Already for some years it has thus been necessary to introduce a third term of conceptual reference: coming to be increasingly utilised is the attribution of peri-urban to indicate the context in which this innovative condition of settlement develops and is consolidated (Barberis 1988, Clément 2005, Donadieu 2006). The adjective *peri-urban* tends to be utilised in order to underline these innovative modalities in the nature of the relationship with the settlement; to underpin a condition of settlement of "other" that is no longer identifiable as either "urban" or "agricultural", which is not related either to the particular sphere of the city or to that of agri-food production. This trend finds its origins in new impulses related to the conditions of necessity, to existential choices, related, for example, to the enjoyment of the landscape and of the natural environment; but most often, it is derived from adhesion to specific "cultural models" that have to do with individualism, with social recognition, and with security. This mode of settlement is in any case characterised by being placed in a non-urban area, decidedly "in the countryside"; what characterises it, what constitutes the primary signifying element of the peri-urban concept, is the centrality of the settlement factor, which proposes itself, however, in a different manner than is typical of both consolidated urban contexts and of productive agricultural contexts. This "third ground" (Caridi 2013), appears at the least "unusual", insofar as it escapes the standard survey instruments, and does not allow interception by rounded forms of treatment via policies/plans: and yet in it will coagulate the most obvious transformations of shape and of settlement practices that characterise contemporary territories; and its elements appear the most dynamic, episodically changing form, nature, and identity. This condition creates difficulties for the traditional categories and paradigms with which we have equipped ourselves over the years, when describing the processes and transformations of settlement; this ends up putting city planning under interrogation, as one of the modalities/disciplines that we have created for addressing the questions and the problems of settled society.

Problematising peri-urbanity

Starting out from these presuppositions, it seems necessary to move in three main directions, namely: i) precisely state our way of conceiving the context of peri-urban settlement, ii) rede-

fine the critical and inventive function of design, iii) orientate the relation of design towards the theme of urban agriculture.
With the objective of clarifying our way of conceiving the context of peri-urban settlement, I propose to break the discourse down into the following steps, imposed according to a criteria of priorities: i) individuate and substantiate the field of discipline related to the peri-urban context. From here it is necessary to research for references to interpret the transformations of knowledge on the peri-urban context in time and from critical reflection on its current form. Subsequently, ii) share a consolidated knowledge about the peri-urban context by feeding the formative processes of research. This means defining models and clear rules, and a consistent and accurate technical language encoded so as to deal with the peri-urban context and discuss it, without misinterpretation. Finally, iii) clearly identify a specific purpose with respect to the peri-urban context. Or, more finally, because the presence of different positions, even contradictory, ends up enriching the scientific community.
To redefine the critical and inventive function of design I believe we must start from the consideration that, today, some of its interpretations, widespread and pervasive even in the sphere of architecture and urban education, as Sergio Caldaretti (2008) pointed out, actually restrict and circumscribe conceptual spaces that, instead, should be maintained as large and open spaces, mutating in relation to the concrete occasions for their utilisation. To remain in the field of observing city planning limits me to underline three specific options that appear particularly negative: i) Limiting the object. This translates into considering the design context as functional to the production/organisation of artefacts, disregarding the relationship with the social context; ii) Positioning of the designer outside the object and the presumed superiority of "technical knowledge" over "social knowledge"; iii) Swift precession from the image and conclusion of the design before its prefiguration materialises. This translates into a disinterest towards the modality in which the settlement is preFig.d, by a complex flow of events that are not reducible to a map, to change its nature.
Finally, if it is true that for the next two generations, increasingly plagued by environmental problems, history will be characterised by the struggle for survival in the cities, the task for us architects and planners will be to confront this challenge. In this regard it seems appropriate to orientate the designs towards the theme of urban agriculture to transform the peri-urban context for the improvement of the city. In this framework the strategic dimensions of urban agriculture assume an increasingly central role, that makes itself explicit in the relationship between i) urban agriculture and forms of settlement (urban agriculture as a remedy); ii) urban agriculture and context (urban agriculture as territorial design); and iii) urban agriculture and agri-food production (urban agriculture as a necessity). In other words, urban agriculture must constitute a new point of view for the design of the peri-urban settlement context to bring to the fore that which has traditionally been pushed to the margins (or beyond the borders) of the city: the countryside. A "concrete" goal to strive towards is ensuring that the practices of agricultural utilisation of urban and peri-urban land, brought about through a collective management, can mature in settled communities into virtuous processes of interaction and of settlement with an awareness of an "other" value of the land, namely as land, food, work, life: in short, as a common good.

Conclusions

To conclude, we can highlight that a design that is based on pretences of rationality typical of the city planning and of the architectural is inevitably extraneous to the complexity of the peri-urban, even if it is supported by good analytical/interpretative intentions. If you want to avoid this drift it is necessary to give a different sense, and follow a path that avoids self-referential procedures, extraneous to any real relationship with the context. It is necessary to draw out a design path from within the dynamics of social interaction, bringing with them indifference, cooperation, and conflict. You must immerse yourself in a creative process that takes place in any case, even without an explicit intention: the settlement contexts continuously conform themselves, changing their symbolic value, functional through an implicit path of self-organisation, that derives from the changing outcomes of the interaction among the subject users, and between them and the space used. The sense of design in the context of peri-urban settlements, and the consequent role of the designer, may be revealed only by making this process as explicit as possible, trying to bring out, to make evident, the elements of self-organisation; and to gradually re-orientate it towards a path of tendency, without formally prefiguring a result.

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Smart Landscapes: from Landscapes to Advanced Cultural Districts. Marche Region Case Study

M. Bocci[1], E. Marcheggiani[1], A. Galli[1], C. Smaniotto Costa[2]

[1] Università Politecnica delle Marche-D3A-CIRP, Ancona, Italy;
[2] Universidade Lusòfona, Lisbon, Portugal
(contact: monica.bocci@univpm.it)

KEY WORDS: Europe 2020 Strategy, CLLD, rural strategy, Advanced Cultural Districts, responsible tourism, cultural economy, smart landscapes

ABSTRACT
The work aims to strengthen the belief that the future of territorial development of intermediate regions largely depends on a more effective marketing of local cultural heritage. The role of planning is crucial for cultural landscapes creation. The CLLD -and in a certain way ITI- have been issued in a new form to meet such an issue. The Cultural Districts (DCE) initiative in Marche Region shows a seminal attempt to bring new life to local governance, by boosting impulses to new cultural and creative initiatives (sharing economy, creative commons and many more).

An overview

The work aims to strengthen the belief that the future of territorial development of intermediate regions largely depends on a more effective marketing of local cultural heritage. Far from being an empty rhetoric, such a strengthened relation among places and their memory should revive and reinvent a creative bond entangling culture, food, memories, folk traditions and landscapes. The turmoil of current crisis urges Italian policy makers and local managers to boost the culture-landscape binomial, delivering new models and creative culture-based economy strongly linked to social needs and deeply rooted into the territorial cohesion vision, whose key issue is: create new jobs – especially for young people.
The role of planning is crucial for cultural landscapes creation. Planning gets a meaningful sense playing as connecting media. The place where definition of the main goals are coordinated and articulated in the attempt to bring plans into action. If this is generally true, in Italy more often-different level of planning intersects several territorial plans. In addition, most of the times, these processes overlap each other without the due communication among actors from the different levels. Such a dystopic view creates unbiased results, which a sounder policing among regional and local coordination actors, at the beginning of strategic implementation, would help to mend. The CLLD -and in a certain way ITI- have been issued in a new form to meet such an issue.
According with Europe 2020 Strategy (ERDF, ESF, EAFRD, etc.) the CLLD strategy offers several positive implications for the development of the territories, with regard of rural-

urban settings. These latter particularly benefit from the last novelties stemmed during the revision of the European bottom-up development strategies. CLLD could represent a solid perspective of strategic governance on cultural and creative economy at regional scale, into an European governance framework.
The Cultural Districts (DCE) initiative in Marche Region shows a seminal attempt to bring new life to local governance, by boosting impulses to new cultural and creative initiatives (sharing economy, creative commons and many more). In this frame, the renewed experience of Leader's CLLD –which for the 2014 – 2020 is open to not only rural areas- could play a pivotal role to implement local strategies (both rural and maritime). By merging the demands from the local arena with the urge of regional and local administrations and the LAGs managing bodies, the emerging strategies should be able to give a new perspective to local economy. Either those merely based on the all-too familiar concept sustainable, and that who try to innovative their vision by input from sharing economy, cultural and creative industries, creative commons, Smart Landscapes experiences, etc. (Pine, Gilmore, 2000). Marche Region played a pivotal role to the implementation of the Adriatic-Ionian macro-region, as well, the governing board is gaining positions to play a future role to bid for a policy construction of Marche-Umbria-Toscana Italian macro-region (whose name is still a matter of an open discussion). Being a key region for the overall European Mediterranean strategy into the Adriatic space Marche Region must show a clearer commitment towards an improved governance skill, accordingly to the definition of new strategies and new territorial approaches. The Europe 2020 strategy, with its mainstream of: smartness, sustainability and inclusiveness, represents an unmissable occasion to the regional administration and ministers to prove their overall governance capacity. Conceive Marche Region as a "smart" region means, above all, a strong commitment on innovation. A key issue is represented by the current need to invest to strengthen the R&D network and complete the infrastructural ultra-fast broadband, energy efficiency, better transport solutions, intelligent use of ITC and more, including with it rural and mountain areas also. The current European strategy for Smart Cities and Communities is currently on an advanced stage in urban area, committing cities, enterprises and citizens to improve their life quality standards by sustainable integrated solutions. A similar challenge still has to be risen within in inlands and rural communities. The risk for them to skirt this trend widening the gap laying behind urban areas is real. The task of reversing such an unbiased development is on the regional body shoulders for, the sake of the Europe 2020 Strategy also; whose aim is a territorial balance between small and medium-sized cities, coast and inland areas (Community Led Local Development). This includes a strengthened capacity of deliver the innovative solutions, a better planning ability, a more participatory approach. At the same time, conceive a more "sustainable" region means investing in the prevention of hydrogeological risk, the defense of the coast, preserving the wide historical heritage, improving traditional the local quality food chain and the quality wine production. Finally, aiming to a more "inclusive" region means to strengthen indeed social inclusion, also encouraging a more proactive participation of public bodies to processes. These aspects have become of greater importance given

the crisis of manufacturing sector in an hard phase since 2008, so that set out alternative socio-economic models finding a way out from the economic crisis has become a priority. The key aspect of the Regional governance is to find a synthesis that gives the opportunity to create synergies and generate income for all economic categories, focusing on young generation, supporting the promotion of culture under all forms and inclusive aspects of multiethnic cultural integration.

A new strategic governance approach

The Regional Operative Program, the Rural Development Program and the Regional Social Program (2014-2020) represent the main territorial participative mainframe to support the regional strategies by EU funds (ERDF, EAFRD and ESF).
On one hand, by the Integrated Territorial Investment (ITI) the regional strategy for urban development concentrates resources in the urban (coastal) areas of the region. On the other hand, the Europe 2020 Strategy, crucial in the Community Strategic Framework, strongly emphasizes the goal of inclusive growth through the implementation of new tool delivered by the European Commission, such as CLLD (Community Led Local Development). CLLDs represents an extension of the Leader strategy, historically dedicated to the rural development. By the LAGs local strategies, especially addressed to the coast-inland transect integration, for the 2014-2020 the region aims to rebalance its territorial strategy. This is crucial in a bulk of revision of the governance approach crossing coastal, rural and mountain areas, strengthening social, economic and innovation strategic goals.
In this wake, the European Countryside Movement have recalled the European Commission to deliver a White Paper on rurality (September 2015), asking for a stronger attention from EU on several issues such as:

- an explicit recognition of rural territories as poles of development and innovation contributing to the 2020 Strategy, in a balanced relationship with the urban poles;
- promote the implementation of the Community-Led Local Development (CLLD), based on the experience of the bottom-up Leader method, during the 2014-2020 programming period, in view to deliver greater economic diversification, job creation and local level capacity building in the rural territories;
- be attentive to the place and role given to rural actors and territories in the rural-urban strategic visions. Peri-urban areas have a particular role in this relationship, given their importance in terms of local agriculture, landscape quality, environmental management, employment and social cohesion. The conclusions of the RURBAN project are to be integrated in the new regional policies of the E.U. and its members.

Rural Development Program 2014-2020 shows a shared vision between goals and actions envisaged by the LEADER's LAGs strategy, strongly related to bottom-up approach. The European Maritime Affairs and Fisheries Strategy (EMAFF) 2014-2020 is expected to strengthening integration between the ESI Funds (European Structural and Investment) including the same EMAFF, with the same integrated territorial development strategy. The Community Led Local Develop-

ment (CLLD) has been introduced with European Maritime Affairs and Fisheries Strategy 2014-2020 (EMAFF) giving an interesting opportunity to join with the LEADER Strategy.
Coordinate synergy between LAGs and CAGs through CLLDs will support the definition of common goals and actions aiming to territorial integration between different areas, deeply linked by the need to open to an extensive strategy on the Adriatic-Ionian macro-region.
Furthermore, the European Union has boosted the creation of national and regional observatories. In particular, about the monitoring of rural areas transformations, one of the most important European experience was the "LEADER II European Observatory", whose purpose was to facilitate processes of transfer of knowledge and exchange of experiences between territories and local actors in rural areas across Europe. That initiative aimed to translate experiences into good practices and innovative agricultural and rural policies, supported by geographical information technologies.
Considering the central role played by the agricultural sector in the Marche Region and many of the critical issues (environmental, economic, social) threatening rural areas to establish a regional rural observatory, fits with the needs of:

- defining new models of agriculture to identified geographical areas ecological, environmental,

economic and social sustainable;

- implementing pilot projects on "best practices" on rural areas involving farmers, residents and local administrators.

The Observatory could represent a local support, a monitoring and a documentation center (including the use of ITC and GIS) on rural areas, coordinating actions between stakeholders (farmers, citizens, associations, administrators and research/innovation expertise). This would also fits the National Strategy for inner areas (Strategia Aree Interne) whose aim is to fight marginalization that, in the last fifty years, has affected Appennino's mountain areas. A process due primarily to progressive aging and low birth, lack of infrastructure (roads, railways and broadband connection), unemployment, accompanied by a gradual decrease in quantity and quality of provision of local services. Depopulation caused a progressive degradation of rural areas quality, with negative consequences in terms of environmental risks, natural resources and loss of biodiversity.

Fig. 1. In the wake of the novelty of European common strategic framework our team is mainly committed to work within 1 and 2, whereas DCE shows a strong correlation to them.

Smart Landscapes: Marche Region cultural and creative governance approach

Cultural Districts represents a new approach to the regional governance (Fig.1) by enhancing cultural and creative economy, one of the most advanced Italian examples during last decade. A network of 18 local Advanced Cultural District (DCE) is operative within the region. Marche Region invested – even if not enough – resources marking a clear change of pace in the cultural sector enforcing the Regional network for an overall investment of about 18 million euro with a cofinancing rate of 60% through private funds. Fig.s shown as culture sector in Marche Region attracts yearly more tourist flows. From 2009 to 2013 the risen shows a constant rate of growth from 2009, where the share of cultural tourists was 1,9% of total flux, inward up to the 2013 with about 28.8%. The 18th local Advanced Cultural Districts (DCE) have given a strategic impulse to the regional development by reconnecting material and immaterial cultural heritage, natural resources, wine and food tradition, enterprises, handcraft, innovation, giving a view to new cultural tourism economy tailored to meet the demand of regional, national and international visitors.
Some data can help to understand the regional interest for cultural and creative industries: a public leader coordinates a network of 400 private and public stakeholders, who Teoldi (2004) defined as "cultural manufacture". By a widespread use of communication and information technologies (ITC) the network could hit the target of regional Smart Landscapes flanking the smart cities operation. The final challenge is that such a "cultural and creative cradle" would trigger the born of new creative enterprises.
Regional CLLDs, which interests the territories included into the LAGs Leader areas, could represent a useful tool to flank implementation actions towards an improved bottom-up strategic governance. At the same time, urban settlements, along the Adriatic coast, through CLLD and FLAG Local Development Plans, could foster a sounder tourism policy able to better distribute the tourist flows currently concentrated during few weeks in the summer, reducing the environmental impacts Rural-coastal areas could give this way a great impulse to regional and local bottom up Smart Communities network.

Final considerations

Considering cultural tourism as a target goal, all actions aiming at preserving and enhancing the quality of the territorial and environmental context represent a key resource for international competitiveness.
Smart Landscapes CLLD can be developed according few clear and fundamental actions:

- definition of a new governance for all the areas committed with cultural tourism and environmental protection: it is essential to coordinate intervention axes, goals and actions;
- implementation of a local tourism strategy that has as its ultimate goal in cultural and creative economy based on a coast-hinterland transect and targeted to hit landscape maintenance and the quality of life of its residents and the quality of the experience for tourists;

- the aim must be to create a support which offers new employment perspectives, focusing on young people, through cultural and creative Smart Landscapes opportunity supported by local Advanced Cultural Districts;
- identification of EU projects to achieve the CLLD strategic goals CLLD (ROP, NOP funds, RDP, direct funds: INTERREG MED, IPA, etc.).

All strategies have to integrate actions and financial resources. It is no longer possible divide the levels of governance while aiming at the same goal: strengthening territorial rebalancing.

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From Rome Charter to Heritage Interpretation: innovative Tools For the Conservation, Use and Promotion of Natural and Cultural Italian Heritage

Maurilio Cipparone[a], Ilaria Trizio[b]

[a] Roffredo Caetani Foundation, Via Appia. Km.66,400; Tor Tre Ponti, 04100 Latina (LT), Italy, maucip@me.com
[b] CNR-ITC, Italian National Research Council, Institute for Construction Technologies, via Carducci 32, 67100 L'Aquila (AQ), Italy, ilaria.trizio@itc.cnr.it

KEYWORDS: Cultural Heritage, Natural Heritage, Heritage Interpretation.

ABSTRACT

All the information contained in the "Charter of Rome on Natural and Cultural capital", approved in November 2014 during the Italian semester at the Presidency of the EU Council, and the declaration of Florence approved by ICOMOS, have recently focused the attention on the Environmental and Cultural Interpretation, a discipline that, if properly implemented, could have important outcomes for the conservation of our Cultural Heritage and the job market.

The Heritage Interpretation, indeed, although already theorized since the fifties of the past century and considered, by several organizations and institutions, a powerful tool to manage natural and cultural resources, has been only recently widespread in Europe, developed, for example, by English Heritage or by the Scottish Natural Heritage in the UK. The European vision of the Heritage Interpretation extended its field of action from solely naturalistic and environmental issues, to those involving the historical and cultural heritage of the territories. The two domains, environmental and cultural, as evidenced by the Charter of Rome, are closely related and this relationship should be strategically strengthened. In Italy, the contents of the discipline have been adopted with greater delay if compared to the rest of the European context, but its strongly interdisciplinary connotation is an interesting factor that currently supports its diffusion.

To confirm this, several initiatives are planned in the Abruzzo area hit by the 2009 earthquake, also based on a recent agreement signed between the University of L'Aquila, the CNR Institute for Construction Technologies, the Federparchi, the Roffredo Caetani Foundation and the Pangea Institute, aimed at promoting and developing training and research activities in the field of Heritage Interpretation. This paper is to disseminate the initiatives promoted according to this agreement: they are aimed at experimenting in a particularly rich environmental and cultural context – that is the post-earthquake reconstruction plans in Abruzzo – the opportunities offered by the Heritage Interpretation.

Heritage Interpretation: origin, meaning and application fields

The Heritage Interpretation was theorized for the first time in the 50's of the last century by Freeman Tilden, and adopted by the National Parks Service of the United States. According to Tilden, Interpretation is: "*an educational activity which aims to reveal meanings and relationships through the use of original objects, by first-hand experience, and by illustrative media, rather than simply to communicate factual information*" (Tilden, 1977, p. 8) and it mainly relates to "natural" Heritage. The following "Six principles" have been proposed by Tilden: although having been somehow "upgraded" by other experts and tested for many years in many Countries, they still are considered the "cornerstones" of the Interpreter's profession…

1. Any interpretation that does not somehow relate what is being displayed or described to something within the personality or experience of the visitor will be sterile;
2. Information is not Interpretation. Interpretation is revelation based upon information. But they are entirely different things. However, all interpretation includes information;
3. Interpretation is an art, which combines many arts, whether the materials presented are scientific, historical or architectural. Any art is in some degree teachable;
4. The chief aim of Interpretation is not instruction, but provocation;
5. Interpretation should aim to present a whole rather than a part, and must address itself to the whole man rather than any phase;
6. Interpretation addressed to children -say up to the age of twelve- should not be a dilution of the presentation to adults, but should follow a fundamentally different approach. To be at its best it will require a separate programme.

Another definition is given by Interpret Europe: "The Heritage Interpretation is a structured form of informal learning, which aims to communicate ideas and meanings about a place to its visitors". Interpret Europe is the European Association for Heritage Interpretation officially founded in 2010, which has as purpose the development in Europe of this "discipline" and the international cooperation for the growth of skills and capabilities for the conservation and valorisation of heritage.

In particular, the main aim of interpretation, from storytelling to virtual tours by multimedia devices, from nature trails to wayside exhibits and by many other tools or activities usually designed in interpretive planning of an area or a site, is to "involve" the different audiences creating experiences related to their knowledge which may be helpful to the management and the "conservation" of the resource being interpreted. Therefore, interpretation is also powerful educational tool, accessible and inclusive, to enhance the "sense of ownership" of a community through a "new" discovery and the appreciation of the values of its Cultural Heritage, raising its commitment, its awareness and its participation towards sound conservation policies.

The role of Heritage Interpretation in the Ename Charter

The 16th General Assembly of ICOMOS (International Council on Monument and Sites) held in Québec (Canada), October 4th 2008, has ratified the ICOMOS Charter for the Interpretation and Presentation of Cultural Heritage Sites, named "Ename Charter". Since its establishment in 1965, ICOMOS has promoted the ethic of the conservation and has worked to raise the awareness of the world's Cultural Heritage value in all its expressions.

All Charters issued by ICOMOS, starting in 1964 with the Charter of Venice, have been aimed to state internationally shared principles, that could be flexibly implemented in different local contexts (and in all the Charters issued) and have always highlighted the role of communication for the conservation of heritage sites.

For ICOMOS, the heritage's conveyance by its preservation is an act of communication. Based on this issue, the seven principles of the Ename Charter (1. Access and Understanding; 2.

Information Sources; 3. Context and setting; 4. Authenticity; 5. Sustainability; 6. Inclusiveness; 7. Research, Evaluation and Training) aim to define, to rationalise and to systematise the concepts of the Interpretation and Presentation of Cultural Heritage sites, as well as technologies, research and training, having as its most important objective to promote and to spread the knowledge of Cultural Heritage sites for their protection and conservation.

The Italian context

Interpretation has made its first implementation in Italy in 1983, with a training course carried out by the Lazio Region Park Office, to promote job opportunities in tourism throughout the regional protected areas. The same Office, in 1985, in collaboration with the Tourist Authority of Latina's province, has carried the first training course for "guides" working in the Circeo National Park. Later, in this park, has been founded in 1992 the Pangea Institute, an NGO dedicated to environmental education and training for protected areas staff, which realised the first training course in Environmental Interpretation for selected officers of the National Forest Corps. Since 1992, the Environmental Interpretation has been implemented in many National and Regional protected areas, both with training initiatives aimed to obtain the official title of "Park Guide"-according to the Italian national law on protected areas- with "Interpretation Masterplans" and with the design of structures, nature trails, exhibitions and other interpretive media.
These training activities, during the time, have found occasionally space in University courses, and, recently, the CURSA (University Consortium for Socioeconomic Research and the Environment) has embraced the goals of the project " Profession Future " (forward briefly described) and has designed and promoted a "strategy" named "Heritage Stewardship", aiming to qualify, as interpreters, the Guides members of the National Professional Association (AIGAE).
From the nineties till today, in Italy, as well as in other European Countries, the heritage interpretation has significantly extended its range of action from themes related to "Nature" to those related to historical and cultural heritage. Recently, during the Italian semester at the Presidency of the EU Council in November 2014, the Rome Charter on Natural and Cultural Capital was approved, as a tool specifically finalised to enhance both these Capitals, and to put them together to generate economic benefits, job opportunities and to develop sectors such as the touristic one.
In the same period, during the 18th General Assembly of ICOMOS in November 2014, in Florence, was adopted the "Declaration of principles and recommendations about the value of Cultural Heritage and Landscape for the construction of a society of peace and democracy". The first recommended action of the Declaration states: "To share and experience the identity of communities, through tourism and interpretation". In this recommendation, it is also specifically repeated that "it is also necessary to ensure the dissemination of the heritage interpretation strategies and procedures through a validated process that ensures the quality of information to tourists" noticing as well the need to train Heritage Interpretation experts.

The L'Aquila Agreement and the project "Profession Future"

In this cultural context, amplified by issues related to post-earthquake restoration of the territory of L'Aquila, on 20th March 2015, the University of L'Aquila, the Italian National Research Council by the Institute of Technology of Building, the Federparchi, the Roffredo Caetani Foundation and the Institute Pangea, have signed an Agreement for the "Promotion and development of training activities in the field of the Environmental Interpretation and Cultural Heritage (Heritage Interpretation)".
The Agreement will be the basis to design, in participatory process and to carry out vocational training courses, university courses for Bachelor and Master degrees, according to the strong multidisciplinary connotation of the Heritage Interpretation and considering that the higher education, the research, the testing of new educational methods are the basic requirements for achieving conservation goals and sound management of the Italian Cultural Heritage..
Moreover, with the Agreement, all the partner have approved the "Profession Future" project, promoted by the Roffredo Caetani Foundation, as responsible Authority for the management and the care of an historical and natural heritage of international importance, aimed at the training of new experts in this field. The "Profession Future" vision has been considered by all the partners a valid response to the request for revitalization in areas with significant growth potential, such as to be one of the driving forces to promote new job opportunities even in marginal areas and that, precisely in the context of the Abruzzo earthquake crater, would be accepted and implemented in the activities aimed to the tangible and intangible reconstruction of the territory.

Conclusions

As confirmation of the importance and the relevance of the topics of the Agreement above mentioned, in December 2015, the Italian General Directorate for the Research and Education, in line with the Italian High Council for the Cultural and Landscape Resources, has published the first National Plan for Education to Cultural Heritage, like requested by a Government Decree issued on August 29, 2014, n. 171, for the new organization of the Italian Ministry of Cultural and Environmental Heritage and Tourism.
Starting from the Framework Convention of the European Council on the Value of Cultural Heritage of 2005, signed by Italy in 2013, which highlights how the Cultural Heritage is a source of human development, of enhancement of the cultural diversity, of promotion of intercultural dialogue and also an economic development model based on the sustainable use of resources, the Italian plan recognizes the complexity of education to the Heritage.
This complexity is clearly highlighted in the report drawn up in 2006 for the European Council (Copeland 2006), which has defined the Education Heritage as a global education, interdisciplinary and based on active and participatory methods, which involves both operators of the formal education system (schools, universities) and all the workers in the informal learning areas of the Cultural Heritage.

It is clear, therefore, and according to what has been above mentioned, that heritage education requires the involvement of trained experts that consider the "Cultural Heritage as an object to research and to interpret" (National Plan, 2015, p. 15) and that such "training needs and promotion of research does not find a confirmation in the current training proposals of the universities. Although museum management and education lessons are given in several degree courses, both related to the cultural heritage and to pedagogy, and that have been established some master degrees dedicated to the theme of heritage, the reorganization of the specialization courses in the protection, management and enhancement of cultural heritage (2006) has not provided an educational address to the Cultural Heritage, as well as there is no tradition of study and research in the field of heritage education at the doctorate schools" (National Plan 2015, p. 16).
Based on these considerations, the Project "Profession Future" and the mentioned Agreement do represent an important step in the promotion and the preparation of new experts such as "Heritage Interpreter".

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Archaeology and digital documentation

3E-rural: Towards a Learning Approach of Rural Landscape Heritage

Ugo Comollo[a]*, Giuseppe Roccasalva[a], Ursula Zich[a]

[a] DAD, Dipartimento di Design e Architettura, Polytechnic University of Turin, Turin, Italy – (ugo.comollo, giuseppe.roccasalva, ursula.zich)@polito.it
* Corresponding author

KEYWORDS: smart planning analysis, integrated surveying approach, rural landscape

The essay describes how an heterogeneous set of data can become a tool for understanding and sharing information with public institutions (but not only with them); in particular the article refers to an integrated approach to surveying the rural buildings heritage of the City of Volpiano (a small town close to Turin) which has engaged research groups of the Turin Polytechnic in 2013 to build a sort of data atlas about farms which is now included in a recently published book: Testù F. *et alii*, 2016 (Fig. 1). The different approaches and different points of view converged into this sort of atlas and have allowed a cross communication which was directed to administrators, scholars, up (or down) to the citizens themselves, in order to involve them in the process: facilitating a way to understand and share the informations, to build grassroots to heritage protection and to enhance the rural heritage through the opening of new intervention scenarios following *ad hoc* strategies. The atlas text was primarily written on a regional scale, through the consultation of archival documents, graphical and not, and their subsequent critical analysis (also merged into a GIS); many on-site surveys have provided data, photographs and even interviews with current inhabitants or visitors of the properties.
These data have allowed a later typological reading of the farms, dividing them into four major variants, recognizing the architectural but also the urban planning coherences, such as the position with respect to the Roman land division (*Centuriazione*) or the main road networks. Finally a third kind of investigation, which could be called 'landscaping enhancement' was about a project of routes through the farms of Volpiano; the whole is intended to be a new approach to read and communicate some qualities of the rural landscape that can be summarized with the 3 'Es' mentioned in the title: Electronics, Education, Empowerment.
Six farms were selected among the number of those still existing, they were surveyed with attention to their typological similarities, historic properties and to their alignments and rural roads which are not disappeared, despite the construction of new ones and important public infrastructure.
These six farms have become the narrative element of a «slow travel, method which can lead to a different kind of knowledge» (citing Francesca Fatta, at the Landscape & Archeology conference in Fano, 2016), ranging over the horizon of a traveler, in a human perspective of the path, or

at least at the speed of a bicycle. This slow movement has allowed observations that have built and have merged into a short *carnet de voyage* designed by an architect, sensitive to those certain aspects that normally are difficult to perceive and analyze, thanks to the different timing of the drawing media. The result is a deliberately subjective collection of impressions, feelings and ideas, which provides a view of that rural reality at disposal of heterogeneous readers. One of these observations concerned the impassable barrier between the inside and the outside of these architectures, looking almost like fortifications which, by their same nature, do not show their intimate version to the wayfarer. At this slow, low-tech, it was useful to add another more advanced approach to overcome the limitations that were found in this perception of the observed farms. The use of a drone, equipped with a camera, has allowed a virtual reconnection, at least at the level of drawn representation, obtained on the basis of the pictures, between the two perceptual realities, finally gathered to show the complex, two faces of these architectures. We believe that this example, along with the others in the publication, could be an approach of enhancement to the farmhouses, a possible target for tourist development, but that also could create a system for an aggregate production, which can only be done if you are able to read a connection on the territory.

For these reasons the book, which started as an atlas, becomes much more: a guide to the discovery of not only possible tourist routes, by visible, accessible and summarized information, but also becoming a resource for those who inhabit the territory daily.

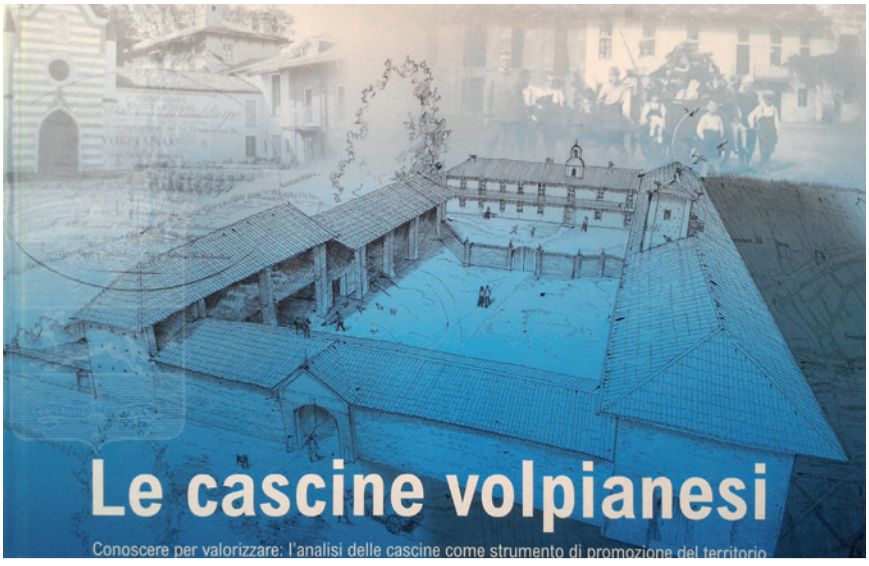

Fig. 1. Cover of the 'atlas' (Testù et alii, 2016)

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Between Archaeology and Landscape. Analysis, Conservation and Valorisation of Early Christian Hypogean Complexes of the South-Eastern Sicily

Alessio Cardaci*, Antonella Versaci**, Luca Renato Fauzia**

* Università degli Studi di Bergamo
** Università degli Studi di Enna "Kore"

KEYWORDS: archaeological landscape, conservation, 3D survey, Syracuse, Sicily

ABSTRACT

The Hyblean plateau, located in the south-eastern part of Sicily, is characterized by human presences that identify a complex and layered landscape, within which a prominent place is occupied by the archaeological remains of the rock culture. Such heritage, placed in an interior area of the island, little interested by tourist flows, require new and more in-depth studies and investigations. From this point of view, it seems imperative the implementation of updated and accurate measurements – not least through the use of 3D representations to understand its complex morphology – and the critical analyses of its conservation status. The aim is to support archaeological research and to increase the interest and curiosity on these valuable pre-existences currently unprotected and, in some respects, very difficult to manage and enhance.

The numerous examples of underground funerary complex in Sicily, all afflicted by the same problems – hard accessibility, poor visibility, small recognition of their historical and architectural value – impose a serious reflection on the challenges and requirements needed to ensure both preservation and revitalization of such a heritage made up of isolated goods. This contribution, focusing on two early Christian necropolis of the province of Syracuse – that of San Martino (Ferla) and that of Cozzo Guardiole (Canicattini Bagni) – aims to bring out the peculiarities of these archaeological remains, which may become effective resources if properly safeguarded and revalued.

Introduction

The feeling associated with the first sensory contact with the landscape of Hyblean Mountains is a pleasant 'stunning' generated by the deep contradictions of this land. First of all, that visual inconsistency determined by the concomitant presence of the dry and rugged rocky plateau burnt by the sun and the sirocco wind, and the blue-green hue of rivers that flow into deep 'hollows' covered by a lush vegetation.

Moreover, the contrast between the smooth and the rhythmic planning of the new towns – embellished by a sumptuous Baroque architecture – and the simple rural settlements that merge and blend into the natural environment, offering a valuable record of a deep-rooted bucolic culture. Finally, the discrepancy of a place that is able to convey the consciousness of an ancient past through the richness of its necropolis and numerous stone churches but which is, at the same time, a symbol of modernity denounced by the presence of many industrial plants on the coast (Fig. 1).

Fig. 1. Ferla, Canicattini Bagni and the specificities of the Hyblean landscape.

An articulated 'archaeological landscape' considered in its broadest sense of diachronic investigation extended from the ancient to the modern period, and applied to a multi-layered context (Cambi, 2015) that can be understood only through its overall reading as a great a unitary system. Landscapes, in fact, – and this in particular – propose an ideal and meaningful picture of their innermost essence. A *genius loci* that corresponds to specific features that must be known and respected before establishing any intervention, and that precisely because of its peculiarities is able to influence the men who, over the centuries, lived there. A common geographical and cultural idea built through the contribution of each part (Maderuelo, 2013).
The archaeological sites in the Hyblean region have not always been studied in a systematic and homogeneous way. Shared and shareable policies aimed at their preservation and enhancement still seem to be lacking. The territory consists of already known areas, such as the Necropolis of Pantalica – inscribed since 2005 on the UNESCO World Heritage list along with the city of Syracuse –, the reserves of Cava Grande and Cava d'Ispica. Yet, it also contains significant evidence, such as the territories of Ferla and Canicattini Bagni: obscure Sicilian villages still waiting for those archaeological and numismatic investigations, which alone would be able to shed light on their birth and evolution (Garro, 2013).
Here, numerous collective underground burial sites or hypogea with great historical and cultural values can be found, unfortunately, plagued by problems related to difficult access and poor visibility. Their current state of neglect, isolation and almost deliberate concealment by the few local scholars, is likely to affect forever their maintenance and transmission to future generations. It imposes a serious reflection on the concrete difficulties related to the preservation and revitalisation of isolated cultural goods.
This work aims to bring out the uniqueness of these archaeological remains, which may become effective resources for the preservation of cultural identity if properly preserved and revalued. The opportunities and potentialities that stem from the appropriate hypothesis of promotion, integration, and connection of the sites were then considered. Based on specific planning policies, they found in the use of the web-based virtual exploration. Resources respectful of the countless meanings guarded by a territory where natural and anthropic factors come together to give life to a palimpsest made by the continuous unfolding of relations and mutual and integrated transformations between the environment and man.

Survey and knowledge of Canicattini Bagni and Ferla sites

The widespread archaeological heritage together with the specific nature of the agrarian tradition and preserved natural features, are the most characteristic aspects of the 'cultural armour' and identity of Hyblean landscape. In particular, the landscape of the excavated architecture is depicted in several sites of this area located between the Sicilian provinces of Catania, Ragusa, and Siracusa.
The two case studies, focusing on the San Martino necropolis in the district of Piano Braida in Ferla and that of Cozzo Guardiole near Canicattini Bagni, are 'monuments' of great sig-

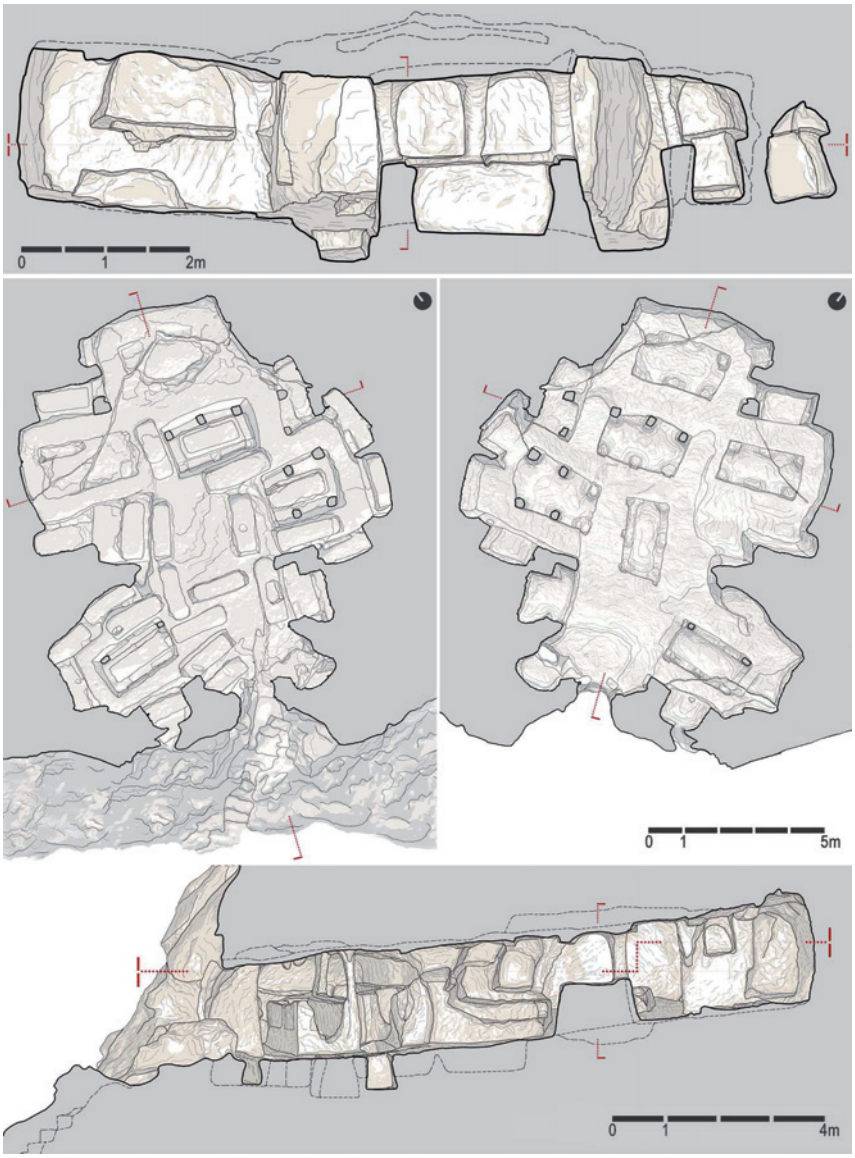

Fig. 2. The survey of Dionisio grotto, in the necropolis of San Martino (Ferla)

nificance for the understanding of the region's settlement dynamics. They are part of a rich heritage constituted of several examples, which depict a historically stratified 'grotto's landscape' – oven tombs dating back to the Castellucian *facies*, chamber tombs from prehistoric, rock settlements – whose value is currently little known and/or recognized (Nucifora, 2008). This is mainly linked to the absence of a comprehensive database overcoming administrative distinctions, able to provide consistent and organized information on a dispersed heritage, for the most part not yet filed. Actually, the few studies carried in the field out refer to historical surveys realised at beginning of the 20th century (Fuhrer, 1907).

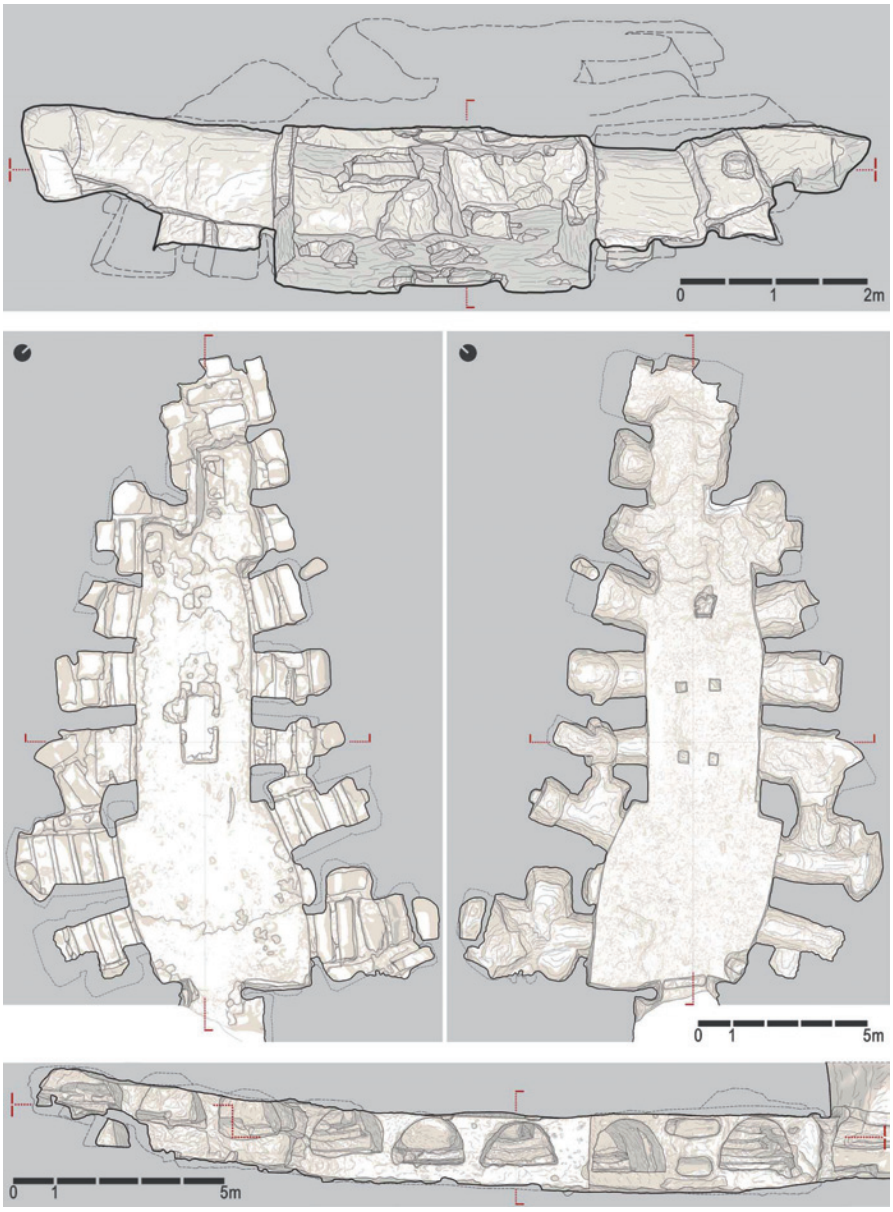

Fig. 3. The survey of major grotto, in the necropolis of Cozzo Guardiole (Canicattini Bagni)

This awareness addressed the objectives and methodological aspects of the study conducted on the architectural features of the Hyblean countryside, with particular reference to those less known.
The first site consists of one hundred caves – many small – that, with the irregular course, occupy the entire rock spur from the valley floor to the summit. Among them, the so-called 'Cave of Dionysius' is of great importance for the presence of an inscription that qualifies it as a burial place for Christian worship (Garro, 2013).

The second considered one of the oldest examples in the hinterland of Syracuse, stands on a rocky hill on the top of which there is a vast early Christian burial ground, maybe founded on an earlier Greek necropolis, consisting of numerous *sub divo* tombs. On the wall sides, partly hidden by the vegetation, numerous caves rise. Among them, the most important in both size and architecture houses many arcosolia polysomes and traces of a canopied tomb (Cugno, 2015).
In both places, signs of the oldest layers and a continuity of both land use and underground spaces can be easily identifiable. The most extensive and morphological complex tombs, originally made by more simple spaces and content, are the result of changes and rooms additions occurred in subsequent stages. The cavities, actually, from initial shelters to escape the persecution of the invaders, were largely used as Christian catacombs in the Byzantine period and adapted to the needs of the community. During the medieval era, they have been abandoned or reused for agricultural purposes such as warehouses or shelters for animals (Messina and Di Stefano, 1997; Messina, 2008).
This cultural heritage, located in an area not so much interested by tourist flows and, in general, little known, has been the subject of in-depth geometric and constructive analysis, for the first time conducted by the authors of this work (Fig. 2-3). The metric and material survey, until now missing, was the first fundamental act pursued. Activities which have been undertaken also using three-dimensional representations and primarily aimed at the production of drawing documenting their state of conservation, today seriously compromised by the action of the weather, vandalism, and human carelessness (Fig. 4). It would also be the indispensable support to the still needed archaeological investigation.

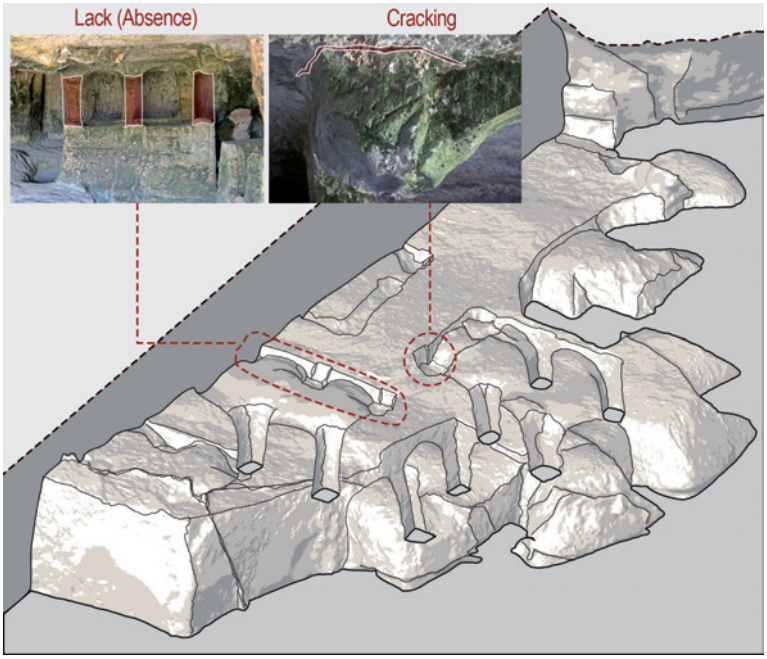

Fig. 4. Axonometric section of Dionisio grotto, detection of conservation vulnerabilities

Actually, if many authors already conducted a thorough study of the written sources and on toponymy, so providing a satisfactory overview of the historical processes and settlement mechanisms, it has, unfortunately, to be noted that there is a lack of excavations, direct surveys of sites and archaeological deposits.
In particular, it is to highlight the almost total absence and the inadequacy of the caves' documentation – to date limited to photographs and incomplete and inaccurate planimetric sketches – as well as of their critical examination. A serious morphological study of underground spaces should instead be tailored to recognize the constructive singularity and conducted according to rigorous and clear measurement procedures, never simplified. Their geometric survey is hardly feasible with the traditional techniques because the volumes are not amenable to regular surfaces. Also, their representation poses considerable difficulties in the graphic transcription of the metric and formal data and appears often insufficient to convey the complexity of the internal space (Patti, 2013).
The use of 3D laser scanning technology and photogrammetric applications of image-based reconstruction now consent to perform accurate and rapid acquisitions, so constituting a valuable research support.
The obtained model – the so-called 'point cloud' – is a vast digital archive that allows an unquestionable ease in the elaboration of orthographic projections of complex surfaces. The irregularity measured by the laser scanner, which results in greater flexibility in the representation in plants and sections as well as in volume, is therefore not a marginal element but a feature that must be cultured and enhanced because very useful in the interpretation of working signs on the surfaces.

For a digital use of the Hyblean archaeological landscape

The cataloguing of rock sites in the digital age cannot ignore the three-dimensional documentation of their morphologies and the web sharing of geo-referenced models. Virtual elements searchable by the user who, in an interactive way, can translate and rotate the object to better understand its geometry and obtain various information (typological definitions, names, dating, references to the relevant literature, texts, photos, movies, etc.) associated with parts of the underground complex to bring out particular stratigraphic evidences or conservation criticalities (Cardaci *et al.*, 2015).
Many museums and cultural heritage administrations have already understood the benefits of the three-dimensional digitization of rock sites and then created web portals where, through virtual reality, the use and dissemination of goods often inaccessible in safety or the conservation of which could be compromised from large flows of visitors, is ensured. However, in the case of Hyblean, we can currently enumerate only some sporadic experiences (mostly University's dissertations) focused on the development of GIS portals on limited administrative portions and declarations of intent by local associations.
To achieve the purpose of a comprehensive and shared classification, in the last decade, especially in the field of archaeological research, it has been paid particular attention to the creation

of 3D GIS platforms. These tools aim to integrate databases – related to archaeological excavations or, more generally, to the census of goods in the area – in the three-dimensional digital reality. It is a field of research that nevertheless presents some critical aspects and limitations to be addressed, particularly related to the problems connected to create an effective 3D GIS. It is for example necessary to better define the data structure, the complexity of the topological relationships in the transition from 2D to 3D and its effective interoperability, through which then make accessible and updatable 3D data models, also on the web (Scianna *et al* ., 2016).
This study has led to the creation of three-dimensional models of the caves from the integration of laser scanning surveys and digital photogrammetry techniques. This activity allowed the necessary updating of the early 20th century surveys, unreliable and incomplete, reaching a very detailed three-dimensional models, which were used to simulate the implementation of web data (Fig. 5a). This process will allow implementing a platform developed by the web player 3DHOP (3D online Heritage Presenter), with other three-dimensional models of the rock sites of the region and its information content. In this way, users would also able to download other multimedia content such as movies and 360-degree panoramic photo. This will agree to freely dispose of 3D data, for example, for the production of physical models of the caves with reverse engineering techniques or to create an immersive experience via the ever more widespread VR viewers (Fig. 5b).

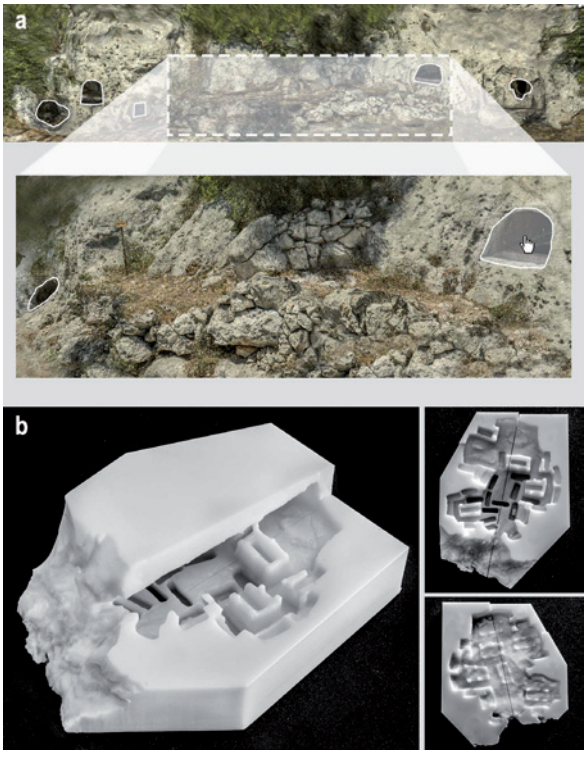

Fig. 5. Potentiality of the archaeological heritage digitization: a) web-sharing of 3D model of the caves; b) 3d printing of a dismountable model of Dionisio grotto

The goal is still to create a database that would virtually connect the popular rock sites in the territory, facilitate the study activities aimed at the research and landscape planning, and make any effective protection and exploitation of the large area. The ability to quickly access all of this information, which constitutes the analytical data to understand the cultural aspects, the exceptional nature, and vulnerabilities of the local landscape, it is necessary for a choral vision of planning actions. This will constructively overcome the debate between scholars and technicians who observe and prepare their assessments and proposals (outsiders) and those who live and continue to build the landscape (insiders) (Gambino, 1997).
The collection of archival documents and literature sources, the field survey, the cataloguing and the digital content production, are the prerequisite to support the growth of this platform that would serve as the tool for a holistic approach to knowledge and dissemination.

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The Theater 'Delle Feste' by Mariano Fortuny: New Frontiers of the Edutainment for the Cultural Heritage

Andrea Marraffa

☞ Ph.D. Student, Dpt. Darte 'Architettura e Territorio' 'Mediterranean' University of Reggio Calabria, RC, Italy – andreamarraffa89@yahoo.it

✔ KEYWORDS: Theater, Fortuny, Edutainment, Semantic Description, Photo-modeling

ABSTRACT: The Theater "delle Feste" (Fig. 1), by Mariano Fortuny and Gabriele D'Annunzio, represents the opportunity for the creation of a new way to conceive the theatrical space's dimension, matching together the imagination and the representation as elements of a new reality. From an unresolved space, the landscape is interpreted and kneaded, producing independence of movements and relationships. The theater appears as an imaginary, utopic, ephemeral and multidimensional space. It s a place without any space, any time, a huge empty box ready to fill.

Fig. 1. Dense point Clouds: hand-made model of the Theater 'delle Feste', computing on Agisoft Photoscan. This image is part of the Ph.D. Thesis, with the title of "La cultura materiale del teatro dello stretto: Nuove scenografie, prospettive e visioni di paesaggio nell'era digitale", currently underway.

The idea of a Fortuny's theater is that of a theater for the community, and it has got simultaneity a bent to the party and the celebration. The total theater (like Gropius did for Piscator) becomes an 'Against-city', a global alternative to the reality in which it floats.
Already Wagner, before Fortuny did, had full awareness about the special duality between the hall and the scene, and the participation of the audience to the action was anymore the mere capturing of artificial space in that reality, but it was a real contemplation of a theatrical action placed in an abstract space.
The main aim is to make possible a dialogue between the cultural world with the new requests and desires of the society, of the so-called global entertainment, in which the theater

can master the media and consumer evolution of prior engagements models. The utopic research, of an architecture of the evanescent to use up physically and virtually, allows to set up new sensitive spaces, in which we can test new shapes and topic, without the bundle of the durability.
It is the chimera of a intangible architecture, of Campanellian memory. As the City of Sun, this theater is a panopticon, radiocentric and encyclopedic city, to be observed, with walls of knowledge, sources of universal memory and pedagogy.
Mariano Fortuny was one of the pioneers of the theatrical reform of the early XX century: from the experimentation of the illuminating engineering interrupted as scenic panting to the charme of the reflected lights, from the project of 'en plein air-theater' to the research about the relationship between audience/stage and actors/spectators, until the invention and the application of the famous dome that has got his own name (Isgrò G., 2014).
His handmade model (Fig. 2) is stewed away in the Museum Fortuny, in the Pesaro-Orfei Palace in Venice. Fortuny's first aim was to built a theatrical device able to set up every possible show, in which the audience had the illusion to be in a completely open-aired space.
Fortuny starts from the idea of the classic theater, studying its structure in the Greek and Roman world. He studied also the Roman amphitheaters and the Hellenistic theaters, not overlooking at the same time the recent experience of the Olimpic Theater, in Vicenza, conceive by Andrea Palladio, first source of inspiration for the theater of the *Feste*.

Fig. 2. Dense point Clouds: hand-made model of the Theater 'delle Feste', computing on Agisoft Photoscan. This image is part of the Ph.D. Thesis, with the title of "La cultura materiale del teatro dello stretto: Nuove scenografie, prospettive e visioni di paesaggio nell'era digitale", currently underway.

In the Theater of the *Feste*, the *velarium* integrated with the dome, shuts the whole structure to shield and protect (even with a philosophic meaning) the community which takes part to the show as a common ceremony (Isgrò G., 1986). The dome, far away to be reduced as a

simple instrument for the mimesis (like sometimes we can observe in the traditional theater) becomes revealing of the light and of its holy meaning, a catching and trigger at the same time, through its awesomeness that integrates itself with a centrifugal and centripetal force.
The idea of a spherical cap that protects the community, guaranteeing the union, does not keep out the opening to the exterior: this is the main and basic principle of the theatrical building designed by Fortuny. Fortuny's dome gives the optical illusion of a celestial vault, thanks to some tricks of reflected and diffused enlightenment. It removes every hardness and every possible conflict with a direct enlightenment. His solution is linked to the dynamic use of the turning scene, to the multiple scenic places and to every other element of decoration of the scene, looking to the simplification and to the reduction of the elements on the stage. The theatre doesn't dispel itself in the city and Fortuny proposes a harmonic structure that has a perfect sync with the outward (Turri E., 2006). It is the starting point for the creation of new space-temporary models so-called 'fluids' in which, beside the constant research of an immaterial idea of lightness, characterized by a strong multi-sensorial way, we could create sensible settings to consume avidly the present time. It preserves the dimension of a Never-land, a dystopian vision of reality which can exist only in a digital world (represented by the lightness of the point clouds).
The hand-made model has been scanned (Fig. 3) by using the methodology of the Structure from Motion (digital photogrammetric survey), processed on Agisoft Photoscan Software.

Fig. 3. digital photogrammetric survey. This image is part of the Ph.D. Thesis, with the title of "La cultura materiale del teatro dello stretto: Nuove scenografie, prospettive e visioni di paesaggio nell'era digitale", currently underway.

The idea of the theater, that of the dome and of the celestial vault, also the idea of the walls of knowledge, become themselves an eternal present, and everything can be substituted by some concepts of the analogical model. A virtual concept replaces the real theater, the point clouds, which fills itself as an empty boxful (*Wunderkammer* or the Astonishment's rooms). These relationships are promoters of new spaces, physical knowledge, but also of semantic

affichage, which qualify the ludic sense of the discovery and creativity. The modern theater, *en plein air* and without any scene, the crowd theater is the flier to contain and hand out the information, the data and the mnemonic sensations.
The theater has not an unmoved scene: it detaches itself from the container and breaks the imaginary box. The *cavea* becomes itself a real scene and starts to focus the attention to an indefinite focal point, in which the action carries out. The scene's absence is filled by an empty space, an oxymoron vision to complete something that there is not, with something that it is possible to think.
The landscape becomes a dynamical scenario. Its bended walls, that allow a 360° vision, and the giant celestial vault (Fortuny's dome), nestle a free and neutral scene, made of limitless landscapes, always adaptable and active. The theatrical space dispels into the city, and become a gimmick to a sapient integration of modern techniques with old ornaments.

Fig. 4. Cavea, sparse point Clouds. This image is part of the Ph.D. Thesis, with the title of "La cultura materiale del teatro dello stretto: Nuove scenografie, prospettive e visioni di paesaggio nell'era digitale", currently underway.

The digital space (Fig. 4) becomes the most promising and very flexible. There are many relationships between ephemeral architecture and digital techno-culture. These relationships produce new fields, not always concrete and tangible, fomented by a network of dense connections (planning, symbolic, representative, cognitive, technical, esthetic), that suggest the topic of the trespassing, essential activity to renovate the value of the research, the playful sense of the discovery, the utopia, the creativity.
In the communication of the culture, the container that reveals itself, as lighthouse of the spreading of the cultural light, is the museum. But the mean of museum here overpasses the traditional vision of the passive consumption of a static and dead cultural supply. The museum always had a fundamental role, as container and dispenser of information. The theater-muse-

um becomes an everlasting prosthesis of mnemonic sensations, a great medium to perceiving and going through the reality.
A strong impulse in the new museum concept has given by the evolution of the new technologies of the information, where the technological trial has often become the aim of the discovery. It is possible realizing some products mainly for the divulgation, but also databases and on-line catalogues pointed towards a public of specialists and experts.
The aim of this research is to create new Astonishing Rooms, new imaginary micro-universes, which can reconstruct the magnificence of the world. This container has got a great communicative force and it can become an intense storage of memory.
The knowledge of the landscape can be possible through many multi-sensorial paths, in which the measurable spaces are integrated by dynamic fluxes of movement (tact, smells, flavors). Every act of the perception is often a comparison between the physic and mnemonic image.
The aim of this network of museums is to give back the info to obtain a museum conceived as a communicative building, in which the content has not anymore represents by objects, but by information. Only a virtual place could allow to dematerialize the container.
The emotional involvement to the culture becomes preeminent in this new theater. The knowledge to the scenic action is possible only with an active involvement of the audience and through different and multi-sensorial paths. The technology allows the spreading of dynamic, augmented and increased reality, but not for this reason without cognitive and semantic qualities and reliability. Beside the 3D models, we can pull up also the *ICT* apps for the digital cataloguing and preservation, but even the wearable computers, the fog-screens, the analogical prototyping, the AR screens and the *CAVE* for the total immersion in anamorphic space at the real scale.
To the theater is required to go out from its real walls and to become a part of a wider system, full of possibilities, able to answer to an always more advanced audience and involved to open itself to the city and to the landscape. The theater's end user, is an active and cultural '*prosumer*', at the same time producer and customer of information and data, and it allows him to re-elaborate the cultural offer depending on his interests. It becomes always more fleeting the border between original and traditional culture and its digital model, between education and entertainment: it's started the new Era of the *Edutainment* for the Cultural Heritage (Nanni A., 2000).
The museum has to break his walls and become part of a wider system, full of possibilities and offers, able to respond to the variety of the request of an audience always more technologically advances and involved. The museum site, physical or virtual, becomes an integrated exponential ambience.
The naturalness of the gesture and the elimination of the barriers allows the direct and immersive experience, involving the user in some activities that make funny the learning and the knowledge, maybe based on the reading of the biological signals, establishing an emotive estate and adopting the ambience to the mood of the visitor.
The edutainment (called also educational entertainment) allows the spreading of liquid reality, more dynamic than the traditional culture, but not for this reason, threatening the semantic quality and the reliability.

The virtual heritage allows to build these sharing instruments, supporting the learning and placing at the first place the cultural experiences, to develop knowledge and to create an active approach for new informative and crossed cultural exchanges.

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The Amphitheatre of Volterra: Integrated Survey and Data Representation

Carlo Battini[a], Elena Sorge[b]

☞ [a] DICCA, Dept. of Civil, Chemical and Environmental Engineering, Polytechnic University of Genoa, Genoa, Italy – carlo.battini@unige.it
[b] Soprintendenza Archeologia della Toscana, Florence – elena.sorge@beniculturali.it

✔ KEYWORDS: amphitheater, archeology, reverse modelling, terrestrial laser scanner, photogrammetry

Thanks to the continuous development of surveying techniques, nowadays, a wide amount of information can be acquired in a short period of time. This information often derives from various surveying procedures interacting with one another to enrich the database, which is pivotal to the study of the surveyed subject.
The present article aims to describe how different techniques of expeditious surveys can be interconnected to provide a more detailed description of the studied subject. Some techniques of digital survey, i.e. terrestrial laser scanning (TLS), topography and the structure-from-motion (SfM) technique can be simultaneously used and made to interact with one another, in order to compile an exhaustive database, rich in colorimetric and metric information.
The case study for this research is the discovery of the amphitheatre of Volterra. It was discovered in July 2015 during the clearance operation of a local stream and it is located near Porta Diana, a few hundred metres from the Roman Theatre, which was discovered in the 1950s. The excavation campaign started between October and November 2015 and it revealed the ridges of the structure's support walls. The structure is constituted by three levels, which together are nearly ten metres deep. During a second excavation campaign in May 2016 four other samples were unearthed, which proved, with near certainty, the dimensions of the amphitheatre (82m x 64m).
For the excavation documentation several expeditious-survey techniques were used, carried out with no interference to the archaeologists' work. The surveying stages began with the placement of the main topographic stations to which temporary topographic stations were then linked, as well as the results produced by the other surveying systems. Once the support network was in place, detailed surveys of each stratigraphic unit were then executed, using laser-scanner and SfM techniques. Particular focus was placed on analysing the surveying errors these methods can be prone to. Using TLS systems guarantees an accuracy of circa 2 mm, while with SfM surveying systems there are multiple variables that can influence the generation of the point clouds, which greatly increases or decreases data accuracy. Therefore, the results of the different surveying techniques were compared between a number of sample points. Firstly, a TLS survey was carried out using a Z+F Imager 5006h phase-shift laser, which can scan structures within a range of 79 metres with an accuracy of 2 mm. The single laser shots were aligned by using targets that had been previously topographically surveyed, thus creating a dense point cloud. Simultaneously, a series of photos were taken using the

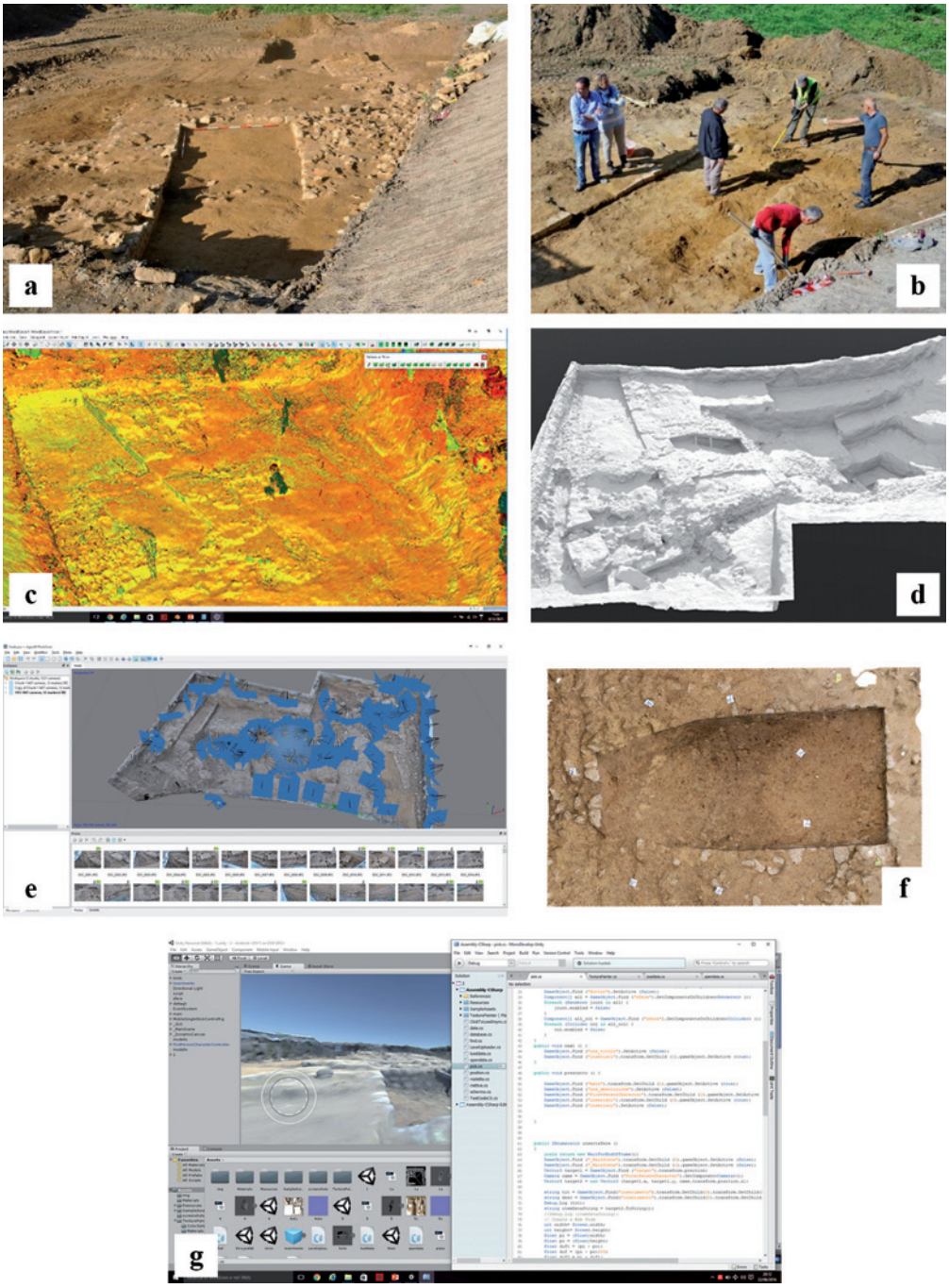

Fig. 1. Images of the processing steps performed: a, b – excavation phases; c – point cloud of the first excavation campaign; d – three-dimensional model of the first excavation campaign; e – three-dimensional model elaborated by the Photoscan software utilising the same targets used in the TLS survey; f – processing of metric images within software PhotoScan necessary to analyse the stratigraphic units; g – development phases of the application of virtual reality designed and programmed within the Unity 3D software

D5000 Reflex Nikon with a 18-105 mm lens to generate a three-dimensional model with the SfM technique. These images were elaborated by the Photoscan software utilising the same targets used in the TLS survey as support points. The two databases created with the different survey systems were elaborated to generate three-dimensional models needed for the comparison. The comparison of the two three-dimensional models was executed using the open-source software, CloudCompare 2.6.2, thanks to which it was possible to overlap and visualise (through a colour-code map) the two different models and to acquire the mean-distance value of 0.002917 m and the standard-deviation value of 0.012793 m. These values are particularly low for the kind of analysed structures. The obtained result was crucial to making specific choices on how to proceed in the following excavation stages. It was decided upon to adopt the SfM technique (with topographic support) to document each stratigraphic unit. This guaranteed a high level of accuracy and made surveying operations less invasive and expensive for the excavation campaign.

In the post-processing phase, the acquired three-dimensional models were used to create the metric images necessary to analyse the stratigraphic units. The models also acted as a base to study an easy-to-use multimedia system to send and manage the gathered information. This created system was an application of virtual reality, in which the operator can browse and study (in three dimensions) the samples carried out by archaeologists. A series of functions were designed for the application to save textual and graphic notes inside the three-dimensionality of the excavation site, by sending the data to the MySQL database positioned on an online server. Thanks to this application, designed and programmed within the Unity 3D software, it was possible to test new systems of data interaction. These tools can be useful for the dissemination of cultural heritage. They create new possibilities for experts in various fields to share and compare information within the same virtual operative structure.

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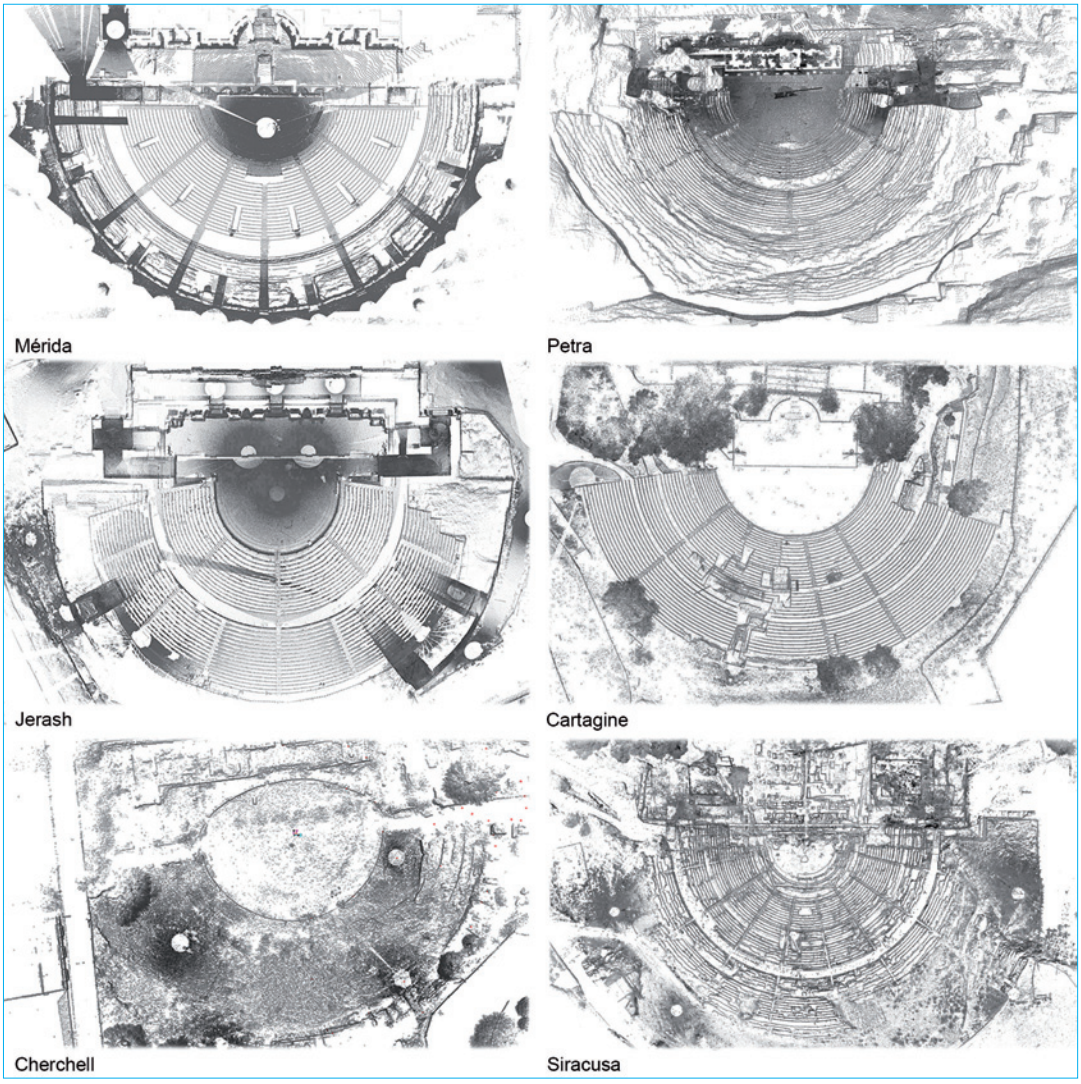
Dynamic Archives: The Documentation of Six Mediterranean Theatres

Carlo Bianchini[1]*, Carlo Inglese[2], Alfonso Ippolito[3]

[1] Sapienza University of Rome, Italy – Department of History, Representation and Restoration of Architecture
carlo.bianchini@uniroma1.it
[2] Sapienza University of Rome, Italy – Department of History, Representation and Restoration of Architecture carlo.inglese@uniroma1.it
[3] Sapienza University of Rome, Italy – Department of History, Representation and Restoration of Architecture
alfonso.ippolito@uniroma1.it
*Corresponding author

Ancient theatres are one of the most extraordinary legacies the Graeco-Roman civilisation has passed on to us: us: from a cultural standpoint, because of the importance that these monuments had in the social life of each community; from the environmental standpoint, because of the enormous skill that went into controlling the structures' territorial and urban impact; and finally, from a 'technological' and functional standpoint, because of the excellence of their distribution patterns and acoustics, hard to equal even today. These very diverse sites with their independent, unique architectural types (almost 1000), as well as the many theatres that still regularly host performances and shows, are scattered far and wide in three continents. The interest and 'success' of Ancient Theatres among the public at large is certainly one of their strong points and the key reason why they survived. However, this 'success' is also the primary reason for their decay: pressure exerted on these structures by the passing of time, exceptional natural events (geological, meteorological, etc.), contemporary use (tourism, performances, setups, etc.) and war-related or socio-political events were unfortunately increasingly frequent, leading to the slow, but often irreversible deterioration of these architectures. Prospectively, the survival of Ancient Theatres will oscillate between these two extremes: on the one hand, a contemporary reuse that keeps their functions alive along with their cultural, social and even economic relevance, but in the medium to long run will lead to inevitable, progressive decay; on the other hand, an uncompromising conservation that by eliminating all manmade pressures would indeed be effective in preserving the structure but would nevertheless condemn it to an inexorable death, culturally, socially and economically.
Since the Declaration of Segesta (1995) twenty years ago, many steps have been taken to develop a strategy that will allow us to enjoy these theatres in the future and allay the risks associated with their use: the Siracusa Charter for the conservation, fruition and management of ancient theatrical architectures in the Mediterranean (2004) is undoubtedly a major step forward, especially because it moves beyond the usual statements of principles. It has proved to be truly valuable, including operationally, in specific activities implemented by those involved in the management of Ancient Theatres. It is this cultural rather than strictly scientific context that triggered one of the most important 'practical' effects of the Siracusa Charter:



the ATHENA Project (Ancient Theatres Enhancement for New Actualities). The Project was financed in 2009 by the European Union as part of the Euromed Heritage IV Programme. It has helped to draft a new, updated strategy for the documentation, conservation, enhancement and sustainable fruition of theatrical structures by turning some of the recommendations in the Siracusa Charter into concrete actions. Not just as proposals or design projects, but by working 'in corpore vivi' in six particularly emblematic sites in the UNESCO World Heritage List (Mérida, Siracusa, Cherchell, Carthage, Petra and Jerash).

Given the above, our research on Ancient Theatres constituted both the scope of our study and also a pretext to analyse the state-of-the-art of the whole field of Survey. No-one can deny there is a clear-cut boundary between *acquisition/representation* procedures – all tendentially focused on 'maximum objectivity' – and *interpretation* which is instead the phase during

which the subject remains the protagonist. Having established this boundary, some segments of the process appear capable of overcoming the stringent requirements imposed by the Scientific Method that other disciplinary sectors normally use in their research activities.
Finally, our research has focussed on a comprehensive assessment of several issues closely linked to the results of the surveying and survey phase. Generally speaking, activities aimed at gathering in-depth information about artefacts can only be considered complete if they provide new content. In fact, data acquisition and processing (which entail the creation of 2D and 3D models) find their natural output in the drafting of hypotheses based on the interpretation of those models. In this framework, the aim of our study was to scientifically interpret the six archaeological complexes and, in order to achieve our goal, we used a consolidated method allowing us to not only examine each theatre individually, but also compare them based on what they had in common. This comparison entailed also an assessment of Vitruvius precepts and Heron rule concerning the estimation of seating capacity.

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A Promenade in Rupestrian Landscapes of Cappadocia. Survey, Notes and New Technologies

Carmela Crescenzi

☞ DIDA, Dept. Architecture, University of Florence, Italy – carmela.crescenzi@gmail.com

1. The rupestrian culture framework

'Living in caves' is still present in many parts of the world, at all latitudes, with different climates and different types of soils. It has continuity in time, places and involves all social layer. Climatic factors, integration or mimesis of the landscape architecture are all elements that characterize the rock architecture and that enhance the economy based on the use of local materials, the variety and treasures of the living space and the play of light.
The study of ancient habitations, carried out almost exclusively by historians and archaeologists, has increased only in the last decades with the interest for its technical and design features. Only the energy crisis of the last years, has led technologists and scholars of the built environment to take an interest in the rock heritage and in particular to study the passive methods of conditioning air and bioclimatic solutions adopted in the ancient "houses of man". In addition, the collapse of many areas has focused the attention on rupestrian sites of multidisciplinary operators for the environment.
The cultural unity of rupestrian settlements was, in some cases, damaged or destroyed, but its relevance as open air eco-museums has never been underestimated, despite anthropogenic deterioration and erosion caused by time conditions.
Recently, the attention was focused on urban settlements, on their different typologies, and on subterranean shelters. These structures are certainly less monumental than churches, but they are more numerous and more extensive and, perhaps, sometime more ancient. (Bixio et Al, 2002; Crescenzi 2012)
Common requirement of the rupestrian sites are the geological and morphological characteristics that have allowed and still allow the excavation of rocks to create spaces for daily activities. As you can see in the five sites examined by the project EU CRHIMA-cinp, the characteristics of the rocks are due to volcanic eruptions that have sometimes deposited soft materials (such as tuffs like in Cappadocia and Santorini) or water sedimentation. All of which resulted in deposits of limestone, sandstones (in Italy) or gypsum (in France), even if there are cavities dug in hard rocks, too, like gneiss, schist and granite (Triolet, 2013)

2. Recognized importance of rock heritage in areas of research

In the countries of the Mediterranean area are considerate Rupestrian Heritage landscape Site.
– the Göreme National Park and the Rock Sites of Cappadocia (1985):

Fig. 1. Rupestrian heritage in the some Mediterranean region.

– The "Stones" and the Park of the rupestrian Churches of Matera (1993)
– Loire Valley between Sully-sur-Loire and Chalonnes (2000)
The research unit of the DIDA, particularly within the PRIN, dealt with some areas in Italy and Turkey.
– In Italy, especially in Puglia, there aren't specific legislative instruments for the rupestrian heritage, so the institutions shall use the regional laws for natural parks equipped to protect and promote the environment of rock valleys.
There are several parks proposed in the Ionian Area, with promise of promotion and funding that waiting the approval.
– In Tuscany and Lazio, in the sector "Land of Tufi", the rock Etruscan testimonies are particularly valued and protected. To these belongs the Archaeological Park of Sovana.
The area of Cappadocia in Turkey has a wealth of valuable buildings and settlements almost infinite and not even all known.
In 2015 it was discovered the cave city of Nevsehir, ancient Nyssa.
The settlement, in use until the early 20th century have preserved the integrity of the landscape. However with the abandonment and with the over construction of masonry buildings, the change of peoples settled and the loss of "knowledge" for the respect of the territory, have in just a century accelerated the lost and the use of land. The protection of territory and works not deemed worthy, or cave churches with frescoes valued by European scholars (French, German and Italian, in the last decades Americans and Japanese) and the amazing underground cities, unfortunately, not yet subject to a check for quality of interventions.
Restorations carried out in unlikely figuratively and structurally way will end up destroying the haunting beauty rock for a kitsch-picturesque. It has been lacking care for maintenance use and slowly it is accelerating the lost of cultural testimonies. This is what happened to many of the villages in the European countries.
However, their valorization is in progress, the economic and touristic development and the growing awareness of citizens of cultural stakeholders are proposing developments of conservation and specimens enhancement which bodes well for the knowledge and appreciation of the rock culture.

3. The project framework

The two projects Crhima CINP ((European cultural Project) and PRIN (2010-2012, Relevant National Interest Research Projects) have created a network involving the existing Open Air Museums and Rupestrian Culture Parks, as well as researchers of interdisciplinary areas
This network will contribute to the knowledge, development and protection of rupestrian Cultural Heritage and their less developed regions.
Subject of the research, it carried out by UniFI-DIDA researchers, is centred on survey, especially on a digital documentation carried out using 3D laser scanners for the architecture as well as about the natural landscape rock of the settlement structure.

So they has been created the first complete and detailed documentation about some interesting areas, in Puglia and in Turkey, allowing the first studies on the urban characters of this archaeological sites.
The two projects are promoted from their web sites, http://www.rupestrianmed.eu (UniFI) and http://www.museovirtualecappadocia.it (UniTus),
The creation of websites and its contents has asked and will require major work that will be used to safeguard the heritage of 'living the rock' which is at risk of destruction.
The research activities and websites, based on the important contribution made by survey, the graphic restitution and visual documentation, that they integrate the scientific, humanistic and technological knowledge, they will enhance for supporting the open-air museum and rupestrian landscapes, and also to make they virtually accessible and enjoyable to all users.
The rupestrian settlements concern the landscape and a the common heritage of European culture, they are the display of an ancient and sustainable "way of life" and an anthropical and natural habitat for life.
Discover and showcase this culture, its virtual musealisation will be an authoring tool to prolong the life of art and biodiversity of rock landscapes and even an instrument of formation and growth of social consciousness for the respect of the environment, considering common good.
Sometimes, the rupestrian settlements valleys are the only natural resource within a city, it built with the criteria of maximum exploitation; the eco-museums, in their own sites, are threatened with depletion and complete destruction due to human exploitation and natural phenomena.
Therefore the innovative proposals for a virtual museum are needed not only to encourage and to develop the tourism, to meet the new demands for user interaction and digital cultural heritage resources, but also to preserve and to enhance tangible and intangible values inside the settlements.
The troglodyte architecture, rupestrian or underground, is an heritage cross of the contemporary "subdiva" culture, implemented over time with variations and is connected to all cultures. The cultural synergies have brought to attention of the "rupestrian culture", a parallel culture and not different from that contemporary.

4. Surveys and notes of the research areas

Surveying and documentation in Cappadocian sites were performed with different methodologies and field work: a few hours hike through in Ihlara, expeditious and instrumental survey for some monuments in Ortahisar historical suburb, and a comprehensive and scientific approach to the area near the Open Air Museum in Goreme.

4.1 Ihlara valley

Ihlara Valley (Fig. 2) is probably one of Turkey's most stunning natural landscapes. A hike through the canyon has been an opportunity to see and quickly gather information on way of life more than 1,000 years ago.

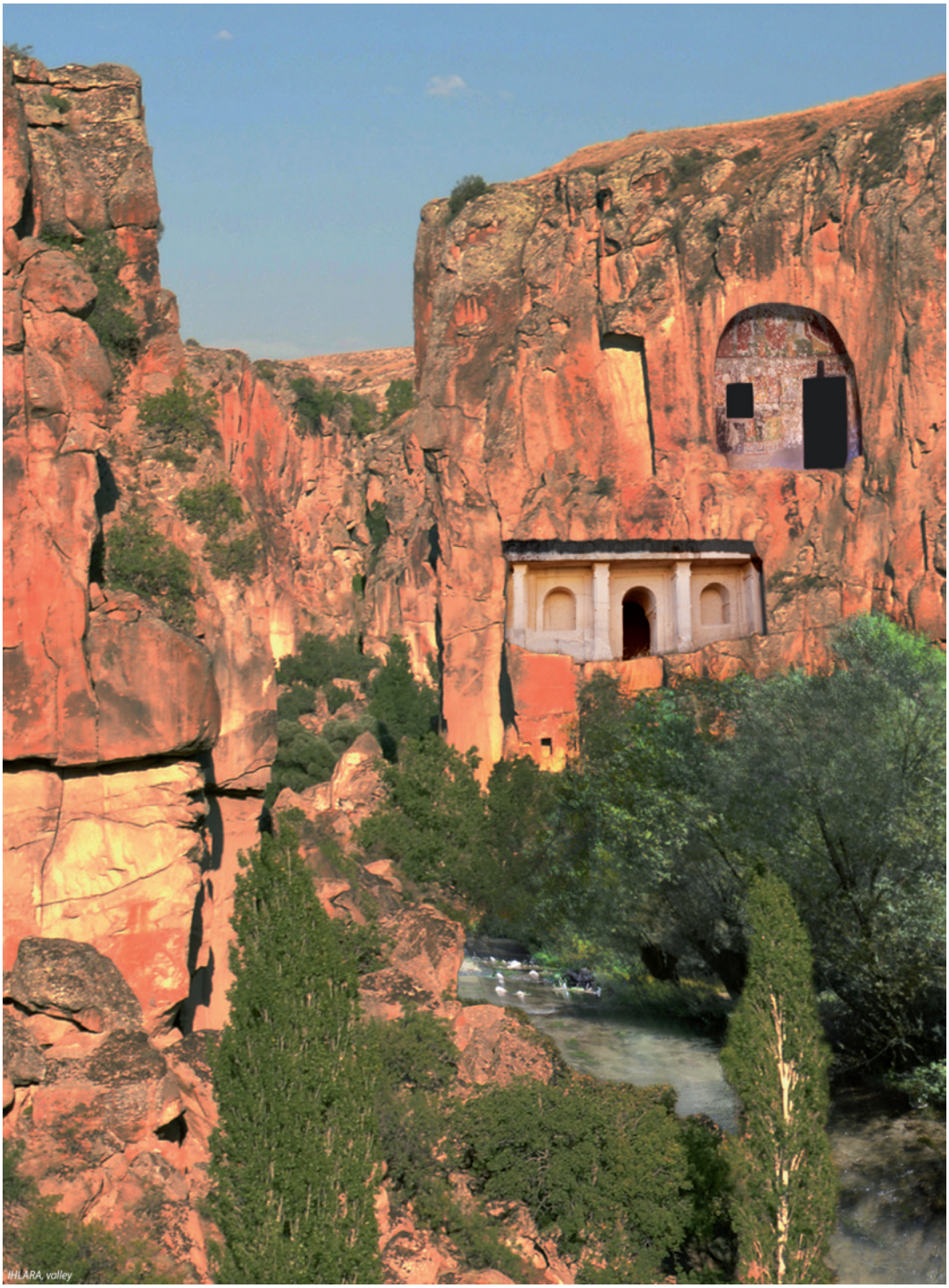

Fig. 2. Hilara valley. Real and patched lendscape of Melendez River. (by C. Crescenzi)

In contrast with the scenical dusty expanses of the rest of Cappadocia, only 49km (30 miles) south of Nevsehir, the austere landscape of the Ihlara Valley reveal itself like a 15km long fissure, the gorge was 100 meters deep. The bottom of canyon, nourished by Melendez River, is verdant with vegetation supporting village life much as it did centuries ago.
The canyon is home to over 100 churches and it is estimated 4,000 dwellings sculpted into the soft rock front of the valley; this has led to believing that the valley was home to a large community of people for many centuries.
The churches, some they are difficult to reach, are date from the 8th or 9th century while the decorative frescoes are date to a post-Iconoclastic period, between the 10th and 13th centuries.

4.2 The settlement of Ortahisar

The town of Ortahisar (Fig.3), selected for the workshop activities of the CRHIMA-cinp project, is located between Nevsheir and Ürgüp.
Currently, Ortahisar is composed of four neighborhoods, the oldest ones being Eski/Atik Mahalle and Yeni Mahalle. Most of the heritage buildings are situated in those two areas. The historical suburb of Ortahisar develops mainly on the terraces of its canyons.
The people, accustomed to the harshness of the territory, have been able to turn the rough conditions of this habitat in their advantage by finding innovative solutions and developing, in the early twentieth century, an extensive use of the stone material.
In fact, the quality features of the carved houses into the rock testify the skilful carving of their inhabitants. Often at entrance of habitations there is a cistern for water collection while inside there are wall cabinets, niches for oil lamps or for the ceramic containers support, fovea or other useful elements for the daily activities.. We can find rich houses with the common room overlooking the open spaces, having beds and sofas with detailed worked armrests collocated in front of finely crafted fireplaces or chimneys carved in large reception rooms. We also find storage rooms or craft activities rooms. (Crescenzi C., 2015)

4.3 The plateau between of Göreme and Kılıçlar valleys

In Turkey The PRIN project focused on the area of Göreme (Fig. 4)
In addition to the landscape of the Göreme Open Air Museum, the survey of UniFI focuses on the surrounding valleys of Göreme and Kılıçlar.
The objective is the realization of a comprehensive study of all the painted churches in this area, consolidated by a research based on the indissoluble union between the natural landscape, the urban planning carved, monuments and decorative art. The project aims at helping to improve their knowledge to a deeper understanding of civil and religious functions, carved rock buildings and the stages of development of the cave settlement.
The original plateau was eroded; their rocky buildings collapsed and they are partially buried by their own ruins. The urban-territorial infrastructure that is best preserved is the singular water system of the valley Kılıçlar still functioning, surveyed in association with the CSS of Genoa.

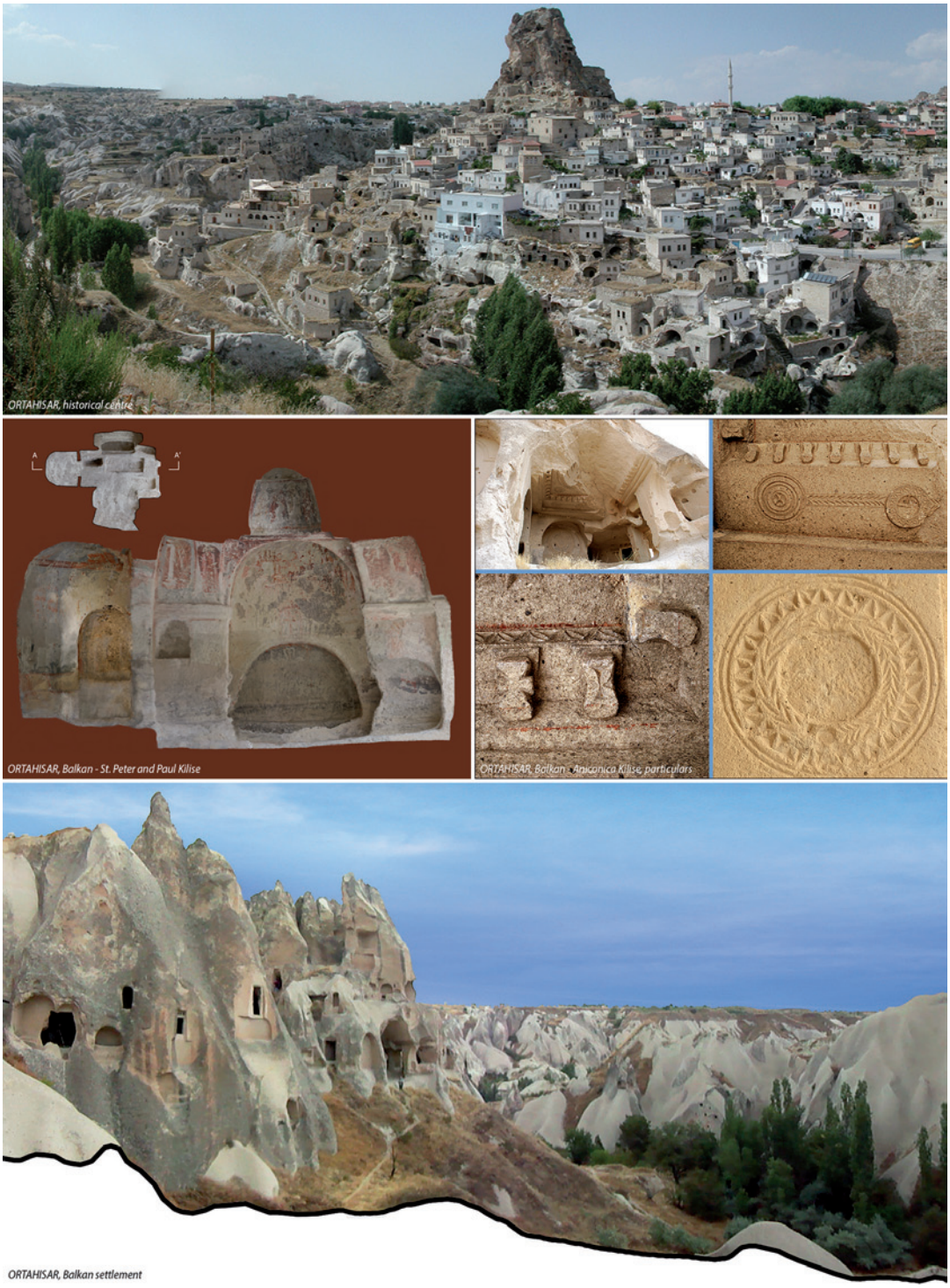

Fig. 3. Ortahisar. Rupestrian village and a its landscape in the area, expeditious survey (Crescenzi 2012)

Several churches are present in the research area, they are the first buildings surveyed thanks to some researcher; for this we can divided the study area is into "insulated" that are made up of an ancient integrated system for living, worship, farming and defensive activities, and they have been identified with the name of the church dug in the same rock complex.
In addition to Tokalı kilise, it is the World Heritage site, we find the complex of St. Eustace, St. Daniel and the Aniconic church, the Théotokos (9 Göreme), the Meryem Ana (27 Göreme), anonymous churches and other chapels (Fig. 5); they have been documented and investigated by interdisciplinary experts.
The settlement has two types of defensive systems: 1) buildings for the community; they have a linear distribution with entrances and multiple escape ways, they are located on the Göreme and Kılıçlar valleys front; we find traces of this type in the complex of St. Eustace, which is sited on the ridge; 2) structure for the individual or family defence and for a short time; vertical or defensive structures, like St. Daniel pinnacle.
The activities, which were common "field work", were carried on among DIDA-UniFi, Disbec-Unitus and CSS, in they took place in the large area upstream of Tokali Kilise (Church of the buckle); it is one of the most beautiful churches in the Göreme Park, a World Heritage Site since 1985.
In this meaningful collaboration, the creation of 3D digital models, starting from an accurate digital survey, is aimed to display the paintings in the excavated churches that host them, allowing a deeper and clearer knowledge of the rupestrian habitat in all of its components.
It will also be very useful for the realization of innovative instruments of fruition, suitable for a presentation of the rupestrian monuments and pictorial decorations scientifically correct and diversified according to different communication levels: virtual reality installations and other multimedia products for the visitors of Open Air Museum.

Notes

The amount of data has been collected in just 21 working days to three research teams involved in photography, in the videos and laser scans.
The ease of Faro Focus, with its low weight and small size, it has allowed us to detect tunnels and steep slopes difficult accessibility. The Surey the Faro Focus has been integrated with the an environmental scale survey with a scanner Riegl VZ400, to T.O.F. technology, that can achieve and measure objects at a distance of 600 m from the instrument.
In case of objective environmental difficulties, has been integrated with the expeditious archaeo-speleological survey. The alignment of 3D point clouds showed the complexity of the underground settlements, some near to the collapse and closed to the public.
Valuable work of the integrated 3D and photographic surveys have allowed the interpretation of the urban structural systems, these have been show with the canonical forms, videos, virtual tours and dynamic records.

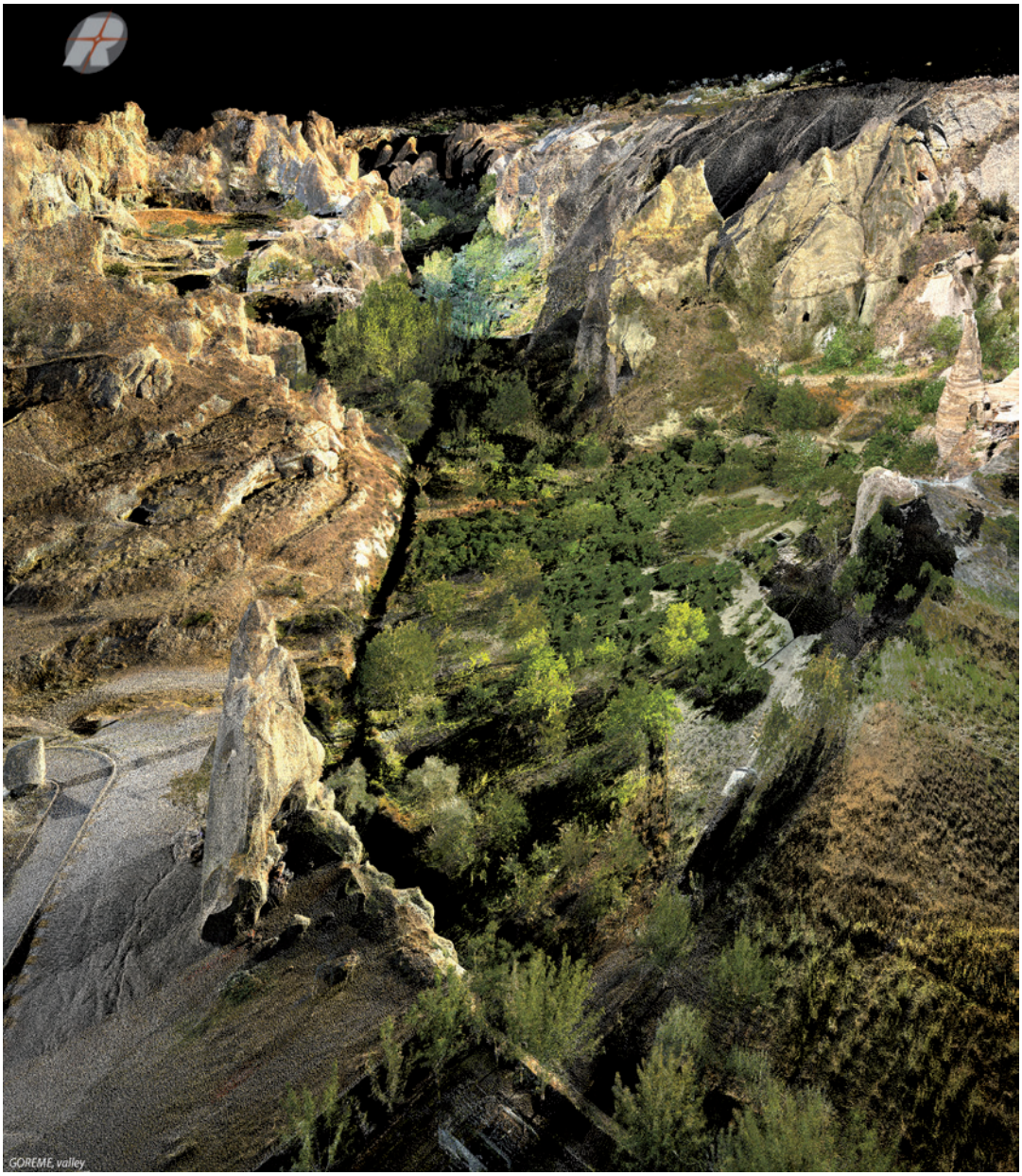

Fig. 4. Göreme valley. The research area on the Byzantine settlement in Göreme valley, previously called Mantiane and Korama, and the Macan and Avcılar during Turkish period, is divided into two parts: the first is the natural exedra of the Open air museum, with a dozen of churches with the refectories; the second is the plateaeu between the Valley of Göreme and Kılıçlar where several rock pinnacles include Tokali kilise, and numerous other rupestrian chapels [Jolivet-Lévy, 2015] . The landscape survey , an environmental scale , has been carried out with a scanner Riegl VZ400 (survey participants: C. Crescenzi, C. Giustiniani, G. Tarabella and F. Tioli; elaboration data F. Tioli); the architectonical survey integrates the landscape one. PRIN 2010-2013, UR UniFI-DIDA

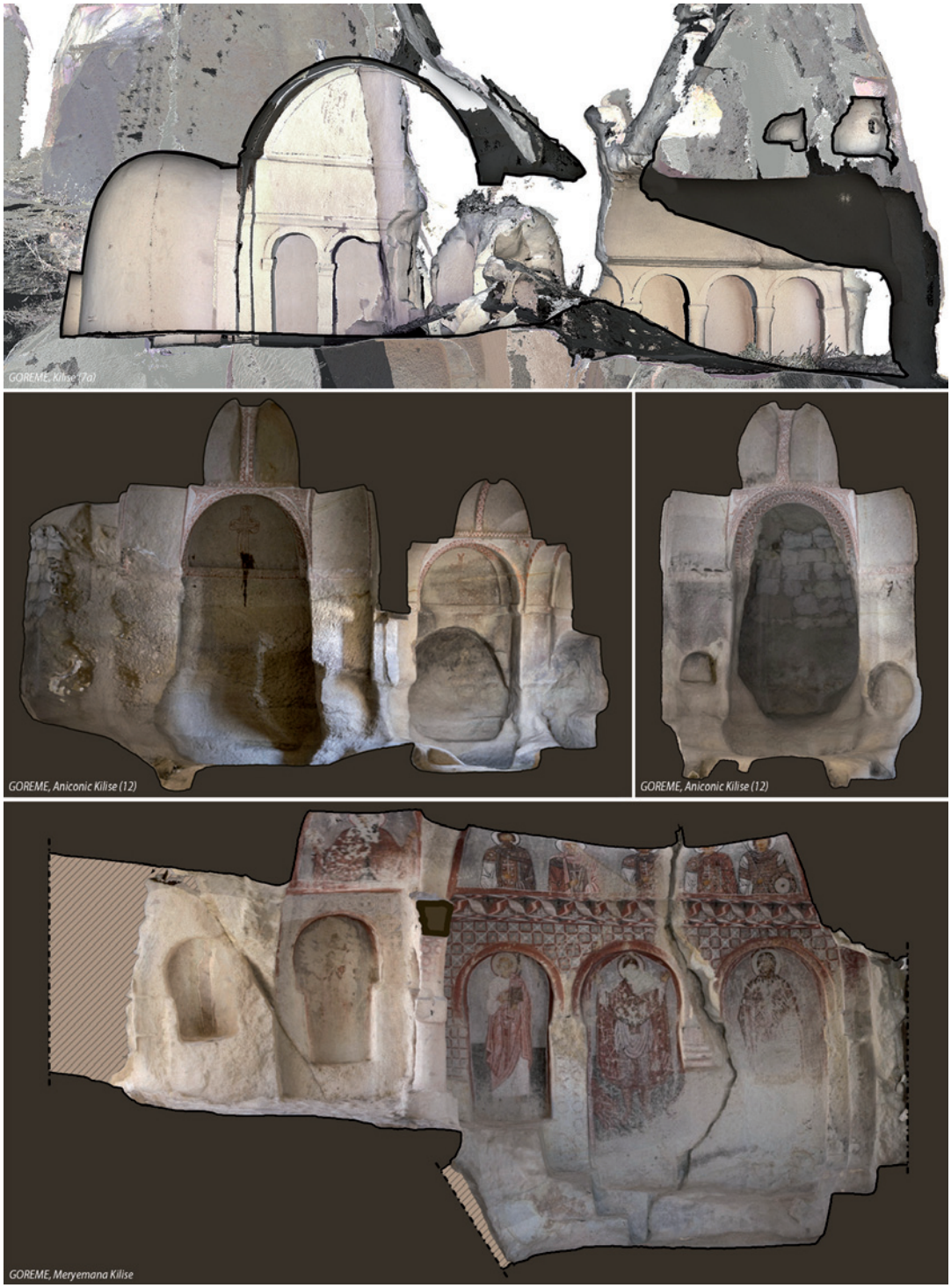

Fig. 5. Göreme. Sections of some chapels (Elaboration: fig. 1, from point clouds S. Stantione; 2-3 from photogrammetrie A. Notarstefano) PRIN 2010-2013,UR UniFI-DIDA

Acknowledgments

The activity carried out is part of the studies initiated in 2007 and treated in the European Project CRHIMA-cinp (2010-12), coordinated by UniFI – DIDA, chef C. Crescenzi, participants countries: Italy, -France, Greece, Spain and Turkey. 2010- 2012.
The same studies were treated also in PRIN 2010-11 (2013-2015), coordinated by UniTUS, of which UniFI-DIDA is UR (Unit research). UR UniFI – DIDA chief C. Crescenzi, researchers: M. Scalzo. G.Verdiani; partecipants PHD F.Tioli, S. Di Tondo; PHD st. C. Giustiniani; survey: arch. S. Menconero, A. Pasquali, arch. j G.Tarabella; st.T. Pignatale, A.Leonardi, elab. data: arch. A. Notarstefano, st.s: A. Charalambous, A. Manghi, S. Nardoni, T. Pignatale, S. Stanzione, E.Vannacci.

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New Perspectives for the Understanding of Extra-Urban Architecture in the Roman Cisalpine Area

Claudia Forin

☞ DBC, Dept. of Cultural Heritage: archaeology, art history, cinema and music, University of Padua, Italy – claudia.forin.1@phd.unipd.it

✔ KEYWORDS: Roman villas, Northern Italy, relational database.

ABSTRACT

This paper presents the aims and partial results of a Ph.D research, focused on Roman farms and villas archaeologically investigated in Northern Italy. The work has provided a systematic census of the sites from the published documentation and the implementation of a relational database, created ad hoc, which has enabled better management and processing of data.

1. Introduction

This paper draws on the Ph.D. research project currently under study at the University of Padua, Italy (Ph.D. Program in Storia, critica e conservazione dei Beni Culturali). The research focuses on the archaeological investigation of the farms and villas in Northern Italy that can be ascribed to the chronological period between Romanization and late antiquity (second century B.C.E. – fifth century C.E.). The aim of this project is to provide a representative framework of the forms and role of extra-urban construction in Northern Italy on the basis on accidental findings. The outcome will be a unitary, annotated collection of the evidence heretofore scattered through local and/or regional publications.

Among the main goals of the project are thus the recognition and analysis of the typological and functional features of the isolated complexes from the Roman era in the attempt to define the numerous factors characterizing them: local traditions, external cultural models (especially from central Italy), and their re-elaboration and adaptation for ideological and functional purposes. Moreover, it is explored the relevant economic and productive aspects by taking into account the geographical context, the vocation of the territories, the production indicators, and the discovered materials, eventually attempting an interpretation of the social status of the owners.

2. Tools

The research project included the systematic, electronic cataloguing of the sites. The data have been entered into a relational database starting from the published documentation, with the addition of newly acquired unpublished material and the autoptic verification regarding some of the sites.

In order to catalogue the sites the *Domvs* database has been adapted and constantly optimized by taking into account the different features of the data needing to manage. The database was initially developed in the context of the "Progetto Cisalpina," coordinated by

Francesca Ghedini (Dipartimento di Beni Culturali, Università degli Studi di Padova) (Ghedini, 2012), with the software *FileMakerPro* (Annibaletto, 2012).
For each analyzed site it was created one "scheda sito" (site data sheet) divided into sections and entries, which includes the essential information and is linked to a "scheda ambiente" (environment data sheet) providing an even greater level of descriptive detail.
At the same time a GIS (with the *QGis* application) is under development: it will allow to compare results on a geographical basis as well.
To date, the cataloguing of the sites is considered complete for the entirety of the territory. We have 203 records thus divided and reported on the map: Valle d'Aosta (5), Piedmont (42), Liguria (8), Lombardy (46), Trentino Alto Adige (7), Veneto (61), Friuli Venezia Giulia (34) (Fig. 1).

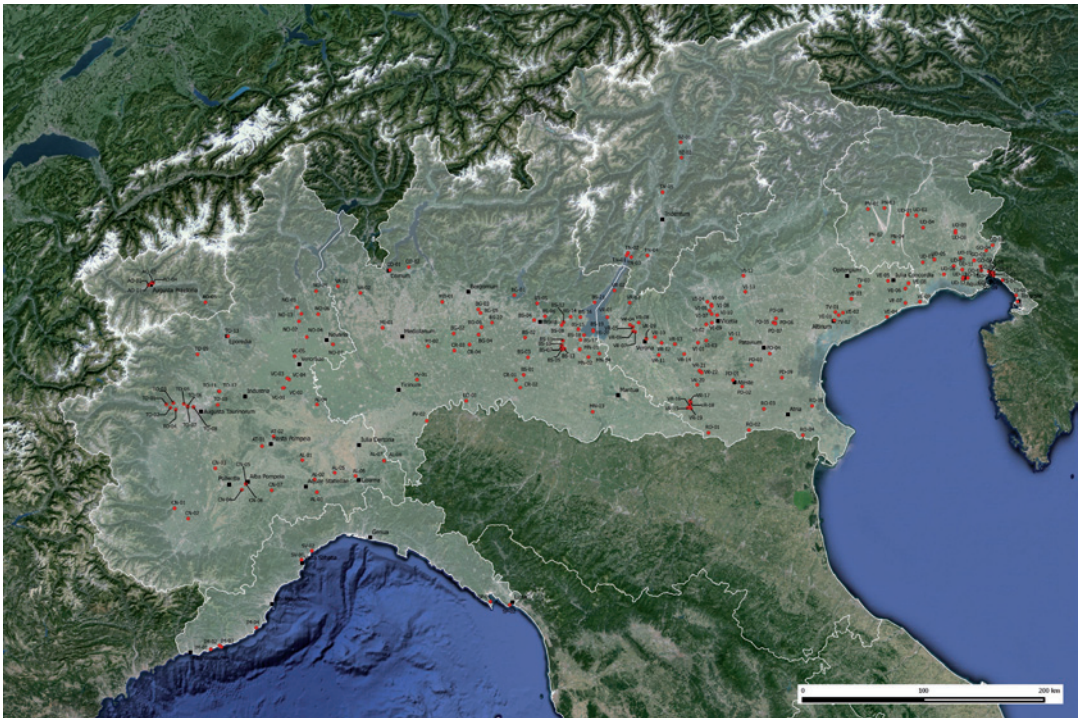


Fig. 1. Map illustrating the distribution of the sites on the territory

As one would expect, the majority of findings is located in the flat areas (61%). A still significant number of findings is located in the hills (23%), whereas the remaining sites are located by the coast (12%), the lakes (4%), the lagoon (3%), and the valleys of the Alpine rivers (3%).
For the analysis and recording of the sites it was chosen to follow the order of the modern division into provinces, for both practical and functional reasons, and thus it has been proceeded from West to East. It was adopted this ordering criterion also when numbering the records "sito" (sites) within the database and the maps, in which they are identified through the abbreviation of the province and a two-digit number (e.g. TO-01, 02, etc.) according to the topographic progression (from West to East and from North to South).

3. Data Analysis and Interpretation: some considerations

The analysis of the documents concerning the residential and productive buildings of the Roman era, developed electronically, enabled to identify some specific features of rural settlements across a very wide and differentiated territory. In this paper it will be presented some considerations, especially on the typological and functional features of the complexes, which were elaborated on the basis of a detailed analysis and accurate comparisons.

3.1 Typological Aspects

The analysis of the sites allowed to formulate some reconstructive hypotheses concerning the general organization of the buildings and the arrangement of the different areas or functional spaces within them. For this purpose, I integrated the data gathered from the published material and (whenever possible) from the archives with the information regarding the distribution of materials on the surface, drawing comparisons with better known cases.
It should be noted that the analysis of the planimetric and architectural features does not aim to establish rigid categories, but rather to contribute to the understanding of the different factors at play – especially in the first, planning phase – by investigating the project's (functional and aesthetic) motives and adoption of external models. To this end, it is taken into account the functional aspects and building techniques, often adapted to the morphology of the territory, in addition to the organization of the building. Observations mainly focus on the organization of the main building, which is identified as such on the basis of its size, its internal configuration, and the construction features; buildings that are separated from it and characterized by a clear utilitarian purpose are identified as annexes. The construction techniques of these structures are often less sophisticated. Plans are available for 171 sites. However, such plans are often limited to such a small portion of the buildings that it is difficult to recognize the essential features of the main building. Considering the most reliable sites, we can propose a reconstructive hypothesis for 65 of the catalogued sites, which, based on all the available data, can be categorized according to six architectural typologies, summarized in the table (Tab. 2).

3.2 Functional Aspects and Typologies of Complexes

Once the objective features of the sites were analyzed and identified by their forms and models, it has been proceeded into a critical analysis of their functional role: specifically, *six functional typologies* were identified and proposed, summarized in the table 3. It can be observed that to each typology (rows) correspond evaluation criteria (columns), which was considered and cross-checked through internal queries to the database in order to determine the distinction proposed (Tab. 3).
The conclusion is that the territory must have been occupied by a widespread hierarchical system of isolated complexes, generally developed since the Augustan age and characterized by a long continuity of frequentation, which lasted until the IV-V century CE, with renovations,

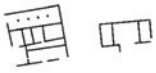
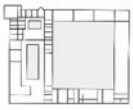
	Architectural typologies	N° Corrisponding sites	Geographical location	Sizes	Residenzial and functional-productive sections	Distribution	Chronology	Schematic plan
Type 1	**Compact building without internal courtyard; with annexes**	7	Rural area, expecially in the plain	From 130 to 350 sm	Not clear indicators of specialization (multi-purpose spaces)	Piemonte (2), Trentino A.A. (1), Veneto (4)	Specially I-II century C.E.	
Type 2	**Separated buildings complex; with annexes**	6	Rural area, in the plain and in the hills	From >250 to >1000 sm	Functional division of the units (similar construction features)	Piemonte (2), Lombardia (2), Veneto (1), Friuli V.G. (1)	I-IV/V century C.E.	
Type 3	**Building arranged around a courtyard; with annexes**	24	Rural area, in the plain, in the hills and in the lagoon	From >400 to 7000 sm	Different functional areas (common courtyard)	Piemonte (6), Lombardia (5), Trentino (1), Veneto (9) Friuli V.G. (3)	End of I century B.C.E.-V century C.E.	
Type 4	**Building arranged around different courtyards; with annexes**	12	Rural area, in the plain, in the hills and in the coast	From 1290 to 8000 sm	Different functional areas (different courtyards)	Piemonte (1), Liguria (2), Lombardia (4), Veneto (2), Friuli V.G. (3)	II/I century B.C.E-IV/V century C.E.	
Type 5	**Linear building with front porch; with annexes**	3	Rural area, expecially in the plain	Front size from 60 to 100 m	Residential sectors in the centre of buildings; functional spaces at the borders	Veneto (3)	End of I century B.C.E-I century C.E.	
Type 6	**Pavilions villas**	1	Rural area	60000 sm	Residential, functional and representation pavilions	Lombardia (1)	IV-V century C.E.	

Table 2. Architectural typologies (Author elaboration)

	Functional typologies	Location and relationship with the territory	Size	Planimetric and architectural features	Decorations	Production indicators	Examples (from records)
Type A	**Small farms**	Rural area, specially in the plain	From 130 to 230 sm	Compact building without internal courtyard: **TYPE 1**	-	-	Pianezza, Boschi S.Anna, Archi di Castelrotto
Type B	**Medium farms**	Rural area, in the plain and in the hills	From >350 to >480 sm	Separated buildings complex or main building with annexes: **TYPE 1-2**	Home decorations materials (clay or bronze)	External crafts activities	Rho, Rosà, Ca Tron-A, Mezzocorona
Type C.1	**Villas with residential and functional areas**	Rural area, in the plain, in the hills and in the lagoon	From >750 to 3000? sm	Building arranged around a courtyard or Separated buildings complex; with annexes: **TYPE 2-3**	*Signinum* and mosaic floors; heated spaces	Medium size production section	Brentino Belluno, Marcaria, Monzambano, Brandizzo, Caselette, Montegrotto
Type C.2	**Villas with residential and functional areas**	Rural area, in the plain, in the hills and in the coast	From >3000 to 7700 sm	Building arranged around a courtyard or Building arranged around different courtyards; with annexes: **TYPE 3-4-5**	*Signinum* and mosaic floors; heated and thermal spaces. Italic models	Highly developed production section	Costigliole, Gavardo, Montichiari, Vicenza dal Molin, San Pietro in C., Venezia Nuova, Varignano
Type D.1	**Representation villas**	Hilly rural area; suburban area	From >2700 to 4000 sm	Compact building with *basis villae* or different levels (terracing): **TYPE 3-4**	Marbles; thermal spaces; italic models	Not attested	Almese, Isera, Aosta, Como?
Type D.2	**Representation villas**	Coastal and suburban area; rural area	Up to 18000 sm	Compact building with *basis villae* or different levels (terracing); linear building with spectacular facing: **TYPE 3-4-5 and 6**	Marbles; thermal spaces; italic models	Not attested	Sirmione, Toscolano Maderno, Fondo Tuzet, Barcola, Desenzano, Palazzo Pignano
Type E	**Production centers** with developed economic activities (minimal residential spaces)	Rural area, close to waterways and roads	Total areas up to 4000, 2500 sm	Separated buildings **TYPE 1-2?**	-	External production areas and specialized buildings	Strevi, Ca Tron-M
Type F	**Villas-*mansiones***	Rural and coastal area; close to roads	From > 620 to 7700 sm	Building arranged around a courtyard or Building arranged around different courtyards; linear building: **TYPE 3-4-5**	*Signinum* and mosaic floors; heated and thermal spaces	Functional and productive sections	Costigliole S., Albisola, Corte Cavanella, Ficarolo

Table 3. Functional typologies (Author elaboration)

plan variations and internal divisions, and repurposing of the spaces. It is possible to distinguish small (*Typology A*) and medium (*Typology B*) farms on the basis of the size of the main building and the presence of materials that seem to reflect, in the latter case, a greater economic and planning effort (home decoration materials, external productive activities, and annexes).
It has been used the term *villae* to designate complexes, identified as *Typology C*, where a clearer economic role can be perceived. Also in this case a distinction may be drawn on the basis of size differences (not only of the buildings themselves but also of the whole property). Such differences are emphasized, in the larger complexes, by the presence of multiple yards and by the effort devoted to the technical and decorative set up of the different functional areas. In the second case the productive areas seem very developed and are larger than the residential sections. *Typology D* identifies a large number of complexes having mainly representative functions, located in rural and coastal areas or in close proximity to urban areas, always in privileged locations. These villas are characterized by an exceptional construction effort and by high-quality architectural and decorative choices, and have mainly residential functions. In this group are included the villas from the late antiquity as well, which, in this case, are distinguished on a chronological basis but also on the basis of the nature of the project, mainly aimed at emphasizing the representative role and the social status of the owner. It remains difficult to interpret *Typology E*, where it would seem we can recognize mainly productive centers with minimal residential space, likely located in the most strategic areas, close to waterways, roads, and not too far from the city.
Some buildings, identified in Typology F, probably had the double function of productive centers and rest stations, built along a road or in close connection to it. These cases are always to be analyzed with the support of the topographic data. The diachronic reading of the complexes constitutes, in addition, a further contribution to the understanding of their economic and social role and allows to link the building of the complexes and their frequentation with the historical events documented in the area between the late Republican period and the late antiquity.

4. Future Developments

The possibility to employ the collected data in the future probably constitutes one of the most interesting aspects in this context, especially in terms of "smart archaeology" (Agosto *et al*., 2007; Ardissone, Rinaudo, 2009; Di Giacomo, Scardozzi, 2014; Semeraro, 2007).
The entering of information into a dedicated database and the final interpretation of the results aim to provide, on the one hand, a comparative tool for future archaeological investigations in the area – from the preventive stage to the interpretation of the findings – and on the other hand a tool for the knowledge, preservation, and valorization of the archaeological heritage.
I think especially about the sites that are not visible or that cannot be visited, but that in the future might be the objects of a "virtual visit" through the extrapolation of concise and essential data sheets, that one will be able to see directly on the territory's map. These data sheets, an example of which can be seen below, may be constituted by selected fields and images (plan and pictures). This may be useful to make these "invisible" archaeological sites known to a non-specialized public as well (Fig. 4).

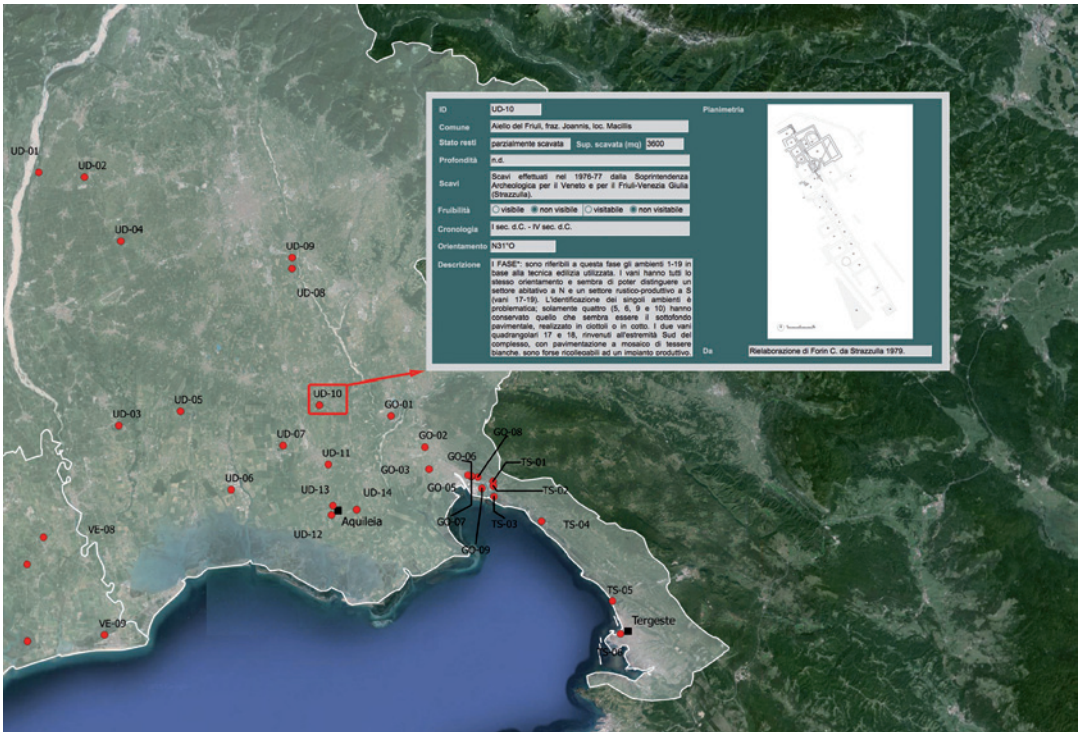


Fig. 4. An example of data sheet extrapolated from the map (elaborated by the Author on a Google Maps database)

In addition, the creation of data sheets aims at constituting a solid reference for preventative measures on the territory, specifically at the planning stage of invasive interventions, such as infrastructures, which generally involve very wide, still little urbanized areas. It is also for this purpose that we created the entries *depth*, indicating the depth at which the archaeological remains have been found in the digging phase, and *orientation* of the structures.

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Weft and Warp: The Identity Path (Flussio – Planargia, Sardinia, Italy)

Danila Artizzu (DA), Vincenzo Bagnolo (VB), Antonio Maria Corda (AMC), Andrea Pirinu (AP)

☞ DA, PhD, Indipendent Researcher. Archaeologist and urban and landscape planner, she carries out researches activities regarding the landscape, artizzu@gmail.com
VB, PhD, Assistant Professor at the University of Cagliari (Italy), he teaches "Survey and Representation of Architecture". He carries out researches activities on architecture and built environment, vbagnolo@unica.it
AMC, PhD, Associate Professor at the University of Cagliari (Italy), he teaches "Roman History" and he carries up researches activities about the historical changes in the landscape during the Roman Era, mcorda@unica.it
AP, PhD, Assistant Professor at the University of Cagliari (Italy), he teaches "Survey and Representation of Architecture". He carries out researches activities on architecture and built environment, apirinu@unica.it

✔ KEYWORDS: Sardinia, Planargia, rural landscape, mills, visual judgement, drawing tecniques.

ABSTRACT
The town of Flussio is located in the heart of Planargia, a Sardinian sub-region sited in the north-west of the Island. The geomorphological variety has defined not only the men's characters and history but also has ridden the appearance of the communities and of the landscape. The micro-region of the Rio Mannu valley seemed an ideal context by interpetating the genesis factors wich the landscape hide in his characteristic patterns and signs. Analyzing these dynamics is not such turning a nostalgic look into the past, but it is to declare the identity of the communities who lives there now. Infact, if they are abled to know the strenght of their roots, they will take an active and conscious part in the development of their territory.

Introduction

The village of Flussio, in the west-central region of Sardinia, is part of a six little hamlets system (Magomadas, Flussio, Sagama, Tinnura, Modolo, Suni) wich are distributed along the edge of the Planargia's basalt plateau. In the early of the XX century, the German linguist and traveler M. L. Wagner described them like different units of a single, large, village (Wagner 2001). From ancient times to these days, the settlement structure has been formed along a main path running on the ridge of the plateau. The two extremes of this road are the historically most important towns: Bosa, at the mouth of the river Temo, and Cuglieri, at the slopes of the another Sardinian sub-region named Montiferru. Along this historic settlement the hierarchies are still perceived with conservatism by the communities who live there. This behaviour daily confronts with the real and profound changes both in the main and secondaries roads net, both in the balances between man and natural resources. These changes were accelerated by the booming of seasonal, coastal, tourism (Pirinu, Sistu 2015). It is an event which has been the subject of a lot of investigations and analysis in order to identify the way for a development more respectful to the nature of the places, more attentive to the culture and traditions of the communities and finally in the aim for a new sustainable economic progress.

(DA, VB, AMC, AP)

History and Geography

The studies about the context in argument are focused mostly on the interactions between the mentioned villages and the coastal environments of Bosa. Furthermore this town is often presented as being the only centrality. On the contrary it could be interesting to observe in detail the plot on which was formed the rural tissue. By this way will be revealed a series of nodes and links which will suggest new addresses for territorial enhancement without turning the landscape into a product for postcards. Infact frequently the danger is, in the name of economic progress, the loss of cultural values and identity for the local communities. Instead, by keeping these intact, the inhabitants could develop their ability to evolve themselves and generate new values.
The territory of Flussio seems an appropriate choice as a case study, mainly for two aspects: the first is linked to its history, the second to its morphology. Historically it was a central location, the capital of the medieval *curatorìa Frussia*, and then with a capacity of the territorial control and management that leads to review what is traditionally considered about the influence of the dominant urban center of Bosa in the Planargia's context (Artizzu, Corda 2016). From the point of view of the morphology and geography Flussio embraces within its administrative boundaries an area which extends longitudinally from the northern brink of the Planargia plateau to the slopes of the massif of Montiferru from which it is separated by the winding course of the rio Mannu. This river also marks the southern borders of Flussio with the municipalities of Sennariolo and Scano Montiferro. Another physical break that marks across the territory is given once again by a river: the rio Molineddu.

(AMC)

The Rio Mannu valley: a dialogue never interrupted

By reading the nineteenth century studies of geographers and ethnographers, the Flussio's inhabitants are described as devoted exclusively to agriculture and viticulture. In fact the area produces the renowned wine named "Malvasia di Bosa", and female activity of interlacing Asphodelus for baskets makes the village popular today as in the past (Angius in Casalis, 1840 s.v. "Flussio"). The landscape mosaic confirms for the areas immediately adjacent to the town and for these over the Rio Molineddu, what is known from the texts. However, the microregion crossed by the Rio Mannu meanders is characterized by some peculiarities that make it different from the picture painted in the past. This area tells us about places that never have known abandonment but, on the contrary, saved in the ages their strategic values. In just 3 hectares of surface, the sample investigated at this stage of research, it has been possibile to recognise the presence of two nuragic towers, of a possible giant tomb, of an ancient paved path, of four water mills and finally of some structures linked to the pastoral life. It is a really interesting phenomenon of overlapping and reuse that shows how the river has never been a break element between those who lived on the plateau and those who stood at the foot of

Montiferru, but on the contrary a hinge between different human habitats. In particular the water mills, along with the the designs of the walled paths and fences related to pastoral life, open a horizon where the farmer/shepherd met the proto-industrial model of the miller's, or fuller's, activities. The result was a division of roles for which one was using the resources offered by the ground and the other one from the water, both transforming the landscape according to their need for life and work. Regarding the circular "pinnettas" (characteristic small stone huts) and the modest stone structures with rectangular plan, the literary sources of the nineteenth century offer an important clarification: these are the traces of a resource management system not related to sheep territory, as easier it could be understood, but to the care of the goats (Angius in Casalis 1840, s.v. "Esiano"). There was therefore a differentiation for which the sheep shepherds did not employ stable structures outside the town, while those of goats, obeying to the different habits of animals, have, in a sense, transported in the countryside some forms of life and living of the village.

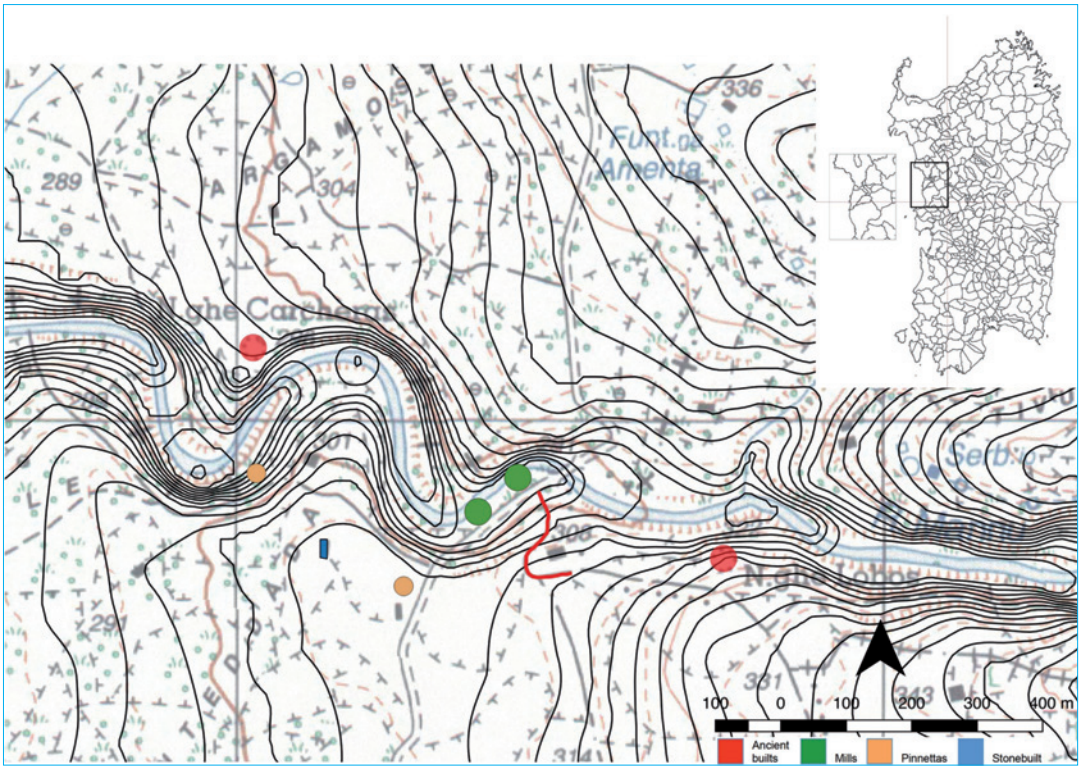


Fig. 1. The area in object: "Vallata del rio Mannu" (elaborated in 2016; sources: DEM SAR 2011; IGMI F. 497 II, Bosa 1994).

The interpretation and the reconstruction of the landascapes layering, brought about the coexistence of different uses of the territory resources, is made possible thanks to the comparison with the data known about the other sub-region of Montiferru. In fact the territorial structure exceeds the administrative boundaries of the different municipalities and even of

the natural ones. The river, contrary to what expected, becomes a vehicle of experiences and an aggregation element: it was in Scano Montiferro, by Sant'Antioco sources, that at least since 1600 along the rio Mannu started up the proto-industrial economy of the water mills for grinding cereals, especially barley (Cherchi 2005, Piras 2010). Over the centuries to the modern age, these installations multiplied with a hierarchy that differs by age, size, quantity of production, processed materials. The landscape of the river, throughout its course, took on a different character and appearance: the owners of the mills diverted the waters not only towards their industries, but also to the small walled gardens. They also engaged in fishing in fresh water on which they had a sort of exclusivity. Even the shepherds/farmers "tanche", the stone constructions and fences of whom it was said below, obey to the cultural models of the work borrowed both from Planargia, both from the Montiferru.
The investigated area doesn't know yet phases of abandonment, but is living a not degraded present by continuing, indeed, to fulfill the traditional role of reservoir of resources. The proof is the care with which, on an individual initiative of the owners, the fences of stone, the paths, the "pinnettas" continue to be restored and used – even if in a different way than the past – with a respect for shapes and planimetries that does not radically upset the original ones. In this picture the exception are the mills because in only one case the build was restored and transformed into a little country house and a a small country. The other similar buildings are in ruins and however it remains uncertain whether were the mills for milling or for fulling.
In despite of that it is undeniable the high value that this particular glimpse of the landscape has retained for the inhabitants who still recognize as its own these places and ask the effective planning tools that allow them and their sons for economic promotion that doesn't involve the dissolution of this heritage. At present there have been some proposals for a tourist and cultural promotion on the initiative of the individual municipalities. These studies include also the rio Mannu contest but only for the segments within the individual administrative boundaries. This attitude first goes against the guidelines defined by the Regional Landscape Plan of Sardinia and second takes discontinous and inconsistent results. At the current state the first step needed is to update the knowledge starting from a complete repertoire, with photographs and reliefs, that witnesses the consistency of the architectural rural heritage and especially hugs in an overview the plot of the marks left from the ancients to us.

(DA)

Visual judgments on location

The issues in the architectural survey of these architectures are mainly represented by the state of neglect of these modest structures and their functional adjoining spaces. The collapse of large portions of roofs, walls, and the massive invasion of the natural vegetation, often make difficult the access for carrying out survey operations. In some cases, the persistence of disuse also made unusable access paths, often concealed by the presence of coulters impenetrable

brambles. Given the difficult access to the different parts of the buildings, in the analysis of these architectures it could be used the so called "visual judgments". Based on a perceptive and intuitive detection, this method allows a direct and immediate relationship with the architectural structure, by returning the documentation of forms, materials and construction techniques (Chiavoni, 2000). Drawing on location implements the reading and understanding the different phases of a built, that is what characterizes each method of architectural survey and representation. The graphic transcription must not arise as purely imitative copy of reality, but as a model of interpretation that returns a synthesis of the identified different qualities. The "visual judgments" starts from the typical concepts of the life drawing, executed in orthogonal and axonometric view projections.

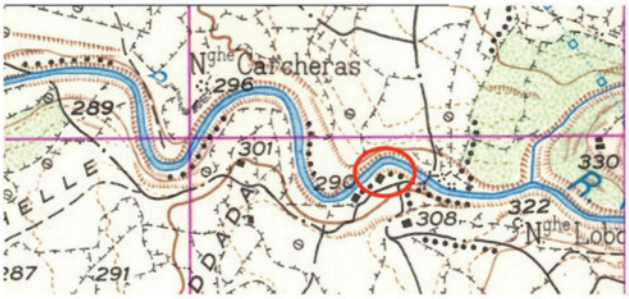
This method is not aimed at the registration of the metric data but creates a graphic base in which the morphological qualities of the architectural work can be represented. In practice, the "visual judgments" consists of two main phases: the so-called "drawing on location" and the subsequent phase of data organization and rearrangement.

The first approach is to identify the architecture proportions. By tracing geometric proportional grids in plan and prospects, it has led to the definition of the main architectural elements, taking care to defer further preliminary surveys all the detailed information provided. The horizontal and vertical alignments, the alternation of solids and voids, are just some of the elements that have guided us in the identification of the main axes and secondary axes. The drawing of the various characteristic axes, in addition to returning a first reading frame of the building, facilitates the positioning and proportions of the various architectural elements. The "visual judgments" survey was made according to a progressive approach to the building, rule always useful in this practice; in this way there is a hierarchy dictated by the progressive recognition of the different identified qualities. Defining first the main elements that characterize the statements, and subsequently drawing the different elements with gradual approaches, the researcher arrives at the final drawing in which he adds the masonry apparatus. In the case of this study for the drawing of the plans of the different buildings, the different proportional relationships have been set in a reference grid to define the interior spaces. The drawing of plans and elevations has been accompanied by the definition of the volumetric diagram for the control of the overall configuration of the building. As well as plans and elevations, they have been carried out so-called "sections in situ", detailed or general, which represent sections of the study carried out on site. In the architectural survey, because of the collapse of part of the buildings and the inaccessibility of certain portions of the surviving structures, it was necessary to draw a reconstructive hypothesis of some sections of masonry, not currently visible. The buildings of the studied mills are all characterized by masonry in stone with two adjoining rooms covered by a single sloped roof, with a wooden structure and bent tile covering. The "visual judgments" of the mills was also aimed at defining a reference typological scheme. This operation will become of fundamental importance as the study is going to be extended to other geographical areas of Sardinia affected by the presence of similar small proto-industrial activities of rural mills.

(VB)

Comune: **Flussio**
Provincia: **OR**
Località: Lobos
Coordinate GPS: 462378; 4453715 WGS 84 UTM ZONE 32

Strada di accesso:
Bacino idrico: rio Mannu
Datazione di impianto: prime tre decadi sec. XX



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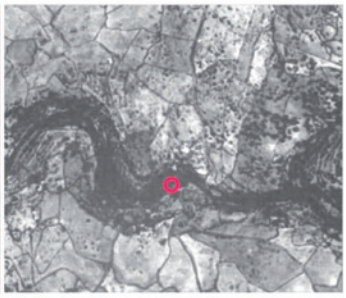

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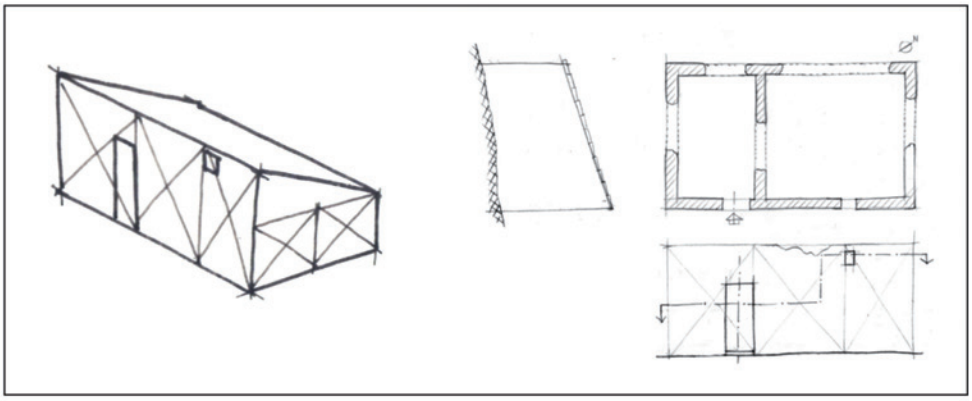

Note storico-descrittive: opificio riconducibile, per confronto con analoghe costruzioni sul territorio, alle prime decadi del XX sec. Tecnica costruttiva: opera incerta in pietrame di natura basaltica con ciottoli come rinzeppature. Pianta rettangolare articolata in almeno due ambienti. Tetto a una falda. Stato di rudere.

Note biblio/sitografiche: cofronti in http://www.mulinidisardegna.it/index.php?option=com_content&view=article&id=252:mulino-f-pes-2&catid=6&Itemid=10, sch. 164

Fig. 2. The outline of a survey's file.

Life drawing: a tool to understand architecture and landscape

In architecture representation, life drawing is a method that encourages the identification of dimensional and architectural elements that make up the object of the survey and needs to understand the building as a whole within the landscape. It provides an effective reading tool that, supported by specialist skills, offers the possibility of a full analysis.
This method has been applied on the three buildings examined, the first two in a state of ruin and the third recently restored, located along the Rio Mannu. Through a sequence of sketches it has been made an analysis focused on the registration of geometric materials and on the construction tecniques and, finally, on the evaluation of relations between architecture and landscape.
The sequence of subsequent graphics patterns, each of which characterized by an increasing degree of graphic deepening, has made possible a gradual analysis by progressive reading levels. The approach phase has required a structuring of a graphic path that come from an extreme synthesis to the drawing of the constructive detail. Then the researcher has been forced, in its adjustment path, to define different graphic constructions that progressively lead towards an increasing detailed drawing.
The buildings, positioned close to the course of the rio Mannu and characterized with an access on the side facing the local road, shows the prevalent use of irregular basalt blocks bonded with mortar for the wall structures and a single-pitched roof facing the river.
By gradual approaches close to the structures, it was possible to check better the details such as the definition of the openings. The graphic analysis shows the relationship between the archi-

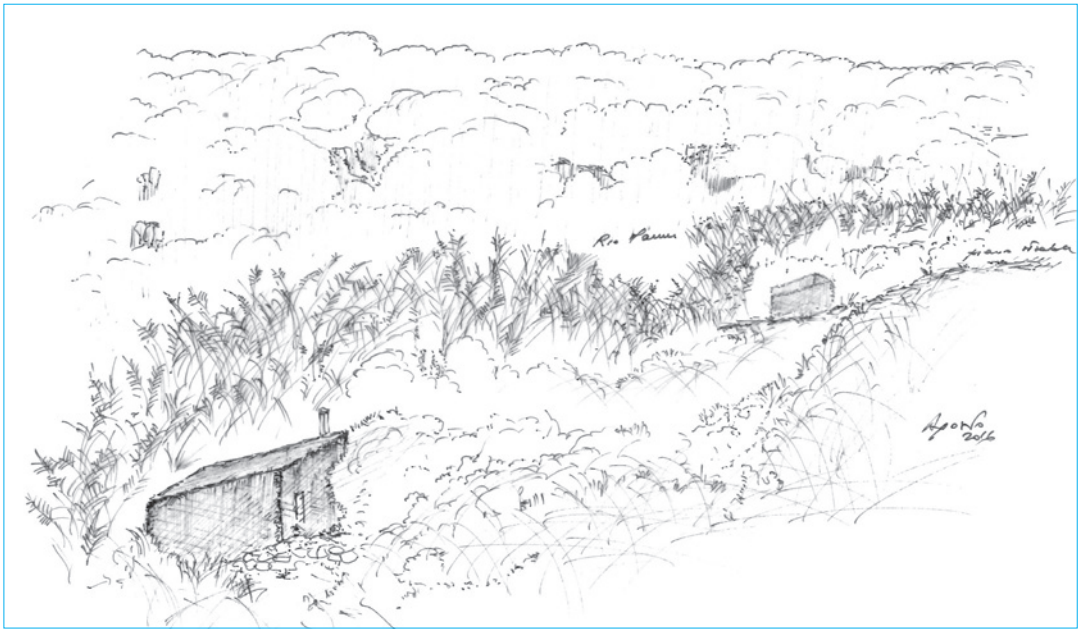

Fig. 3. The river landscape.

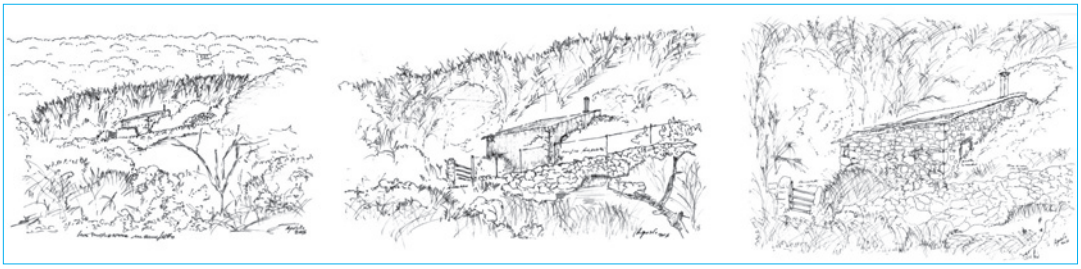

Fig. 4. Progressive approach drawing.

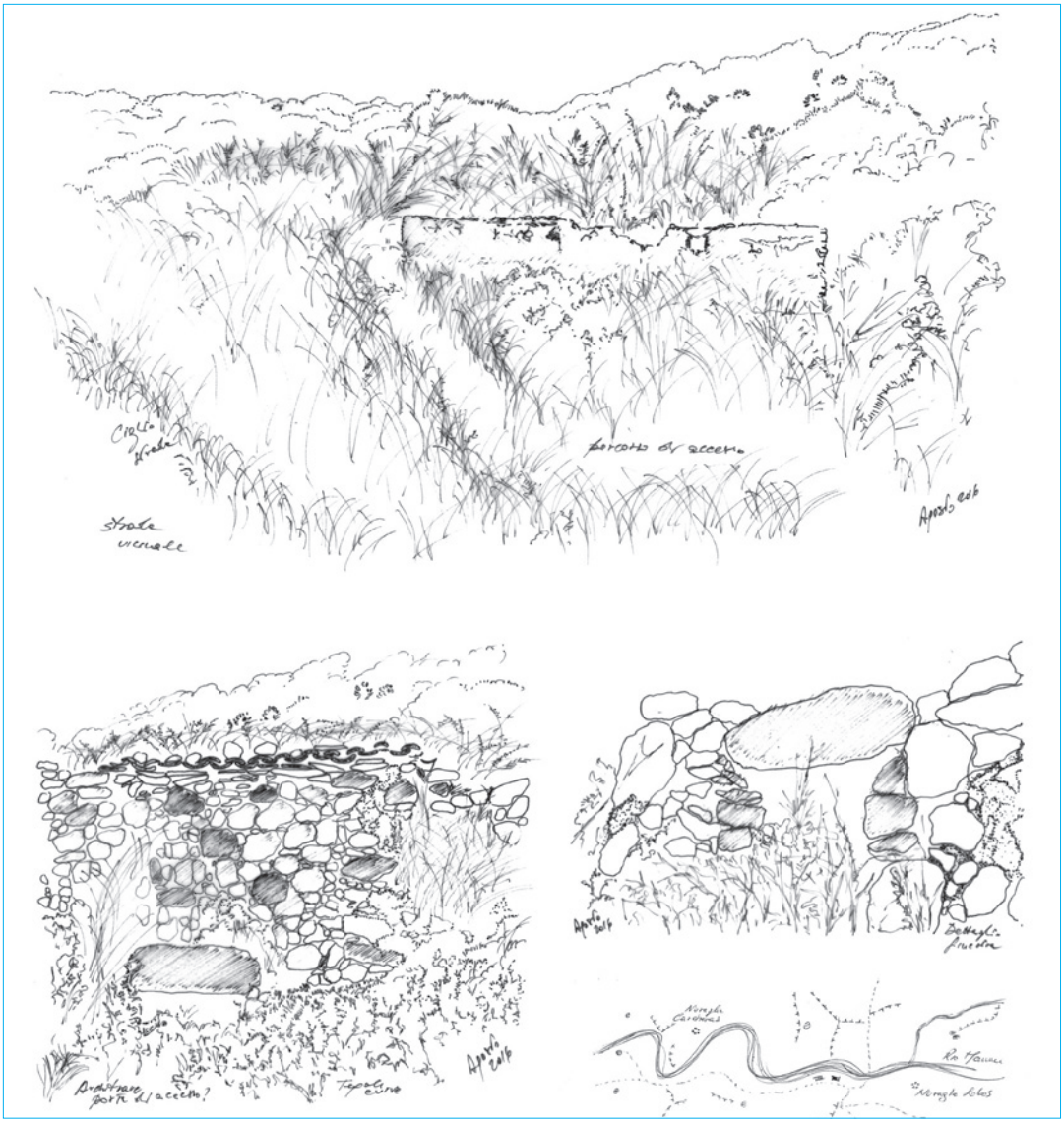

Fig. 5. The mill ruin.

tecture and the site, characterized by a strong link between the construction models and natural forms of the landscape: the course of the river and the reed beds, the mountain ridges and the Mediterranean flora are all elements and shapes that interweave defining the identity of the place.
(AP)

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Survey, 3d Modelling and Gis for Interpretation, Communication and Enhancement of Archaeological Heritage. Landscape Archaeology in Agrigento.

Emanuele Brienza[a], Luigi Caliò[b], Mariangela Liuzzo[c]

[a] Faculty of Classics, Linguistic and Training Studies, Kore University of Enna, Enna, Italy – emanuele.brienza@unikore.it
[b] Dept. of Humanities, University of Catania, Catania, Italy – luigicalio@libero.it
[c] Faculty of Engineering and Architecture, Kore University of Enna, Enna, Italy – mariangela.liuzzo@unikore.it

KEYWORDS: *Landscape Archaeology, Site Survey, 3D Modelling, Ancient Urban Development Analysis*

Agrigento's *upper Agorà* is an area characterised by various structures on various levels: ancient classic architectures were occupied by the Cistercian church of S. Nicola and its monastery, and in the 20th century by the Regional Archaeological Museum designed by Franco Minissi. The morphology of the area is characterised by substantial jumps in elevation, which have been resolved with a clever terracing system.
A three-dimensional survey campaign was carried out in this area integrating 3D laser scanning and GPS technology. The campaign was implemented by Kore University of Enna's "Survey and Representation" Laboratory.
A time of flight 3D laser scanner and a GNNS system with RTK correction were used on a permanent nationwide network in order to guarantee centimetric accuracy and complete integration with the laser scanner data. The geo-referencing system used was the UTM-WGS84, with altimetry measured as heights above sea level.
The survey campaign focused primarily on the ancient architectures currently divided by the regional archaeological museum. On the north side the so-called *Iseion* and the *Bouleuterion* area with its terracing system; on the south the *Ekklesiasterion* and the so-called Falaride Oratory.
This three-dimensional survey had as its objective the connection of archaeological discoveries in a single virtual model. Geographic coordinates were gathered with the GPS survey of various high reflectance targets scattered all around as control points for the 3D laser scanner survey.
This work, based on geographic data, has produced several planimetric orthoprojections of the point cloud model and made possible the integration with a more extensive survey carried out along the remaining terraced sections from the ancient part of the city.
All acquired data were drawn on a vector base-map, scale 1:5000 reporting the new official topographical network developed by Agrigento's Archaeological Park and enriched by updated satellite images.
Our survey has put in evidence new archaeological features which belong to town viability: several parallel SE/NW oriented walls, often retaining terraces, and a new ancient crossroad. In 1958 aerial photo interpretation by Griffo and Schmiedt suggested a regular urban scheme of Agrigento composed by 6 NE-SW oriented main roads dividing the town in strings 300 m long intersected by orthogonal streets and defining blocks 35 m wide (Schmiedt, Griffo, 1958).

In recent times an updated archaeological map of Agrigento has been produced, but without a reconstruction proposal (Belvedere, Burgio, 2012).
The structures found during our work change the scheme of ancient Agrigento urban planning. In our reconstruction the first two main strings from north have the same shape previously proposed but changes are bigger on south side; here the crossroads we found attests the existence of a new *plateia* designing shorter blocks 150 m long. On the south side was another *plateia* flanking the *Olympieion,* and other two short blocks, long 150 m, divided by a street connecting the *Herakles Temple* to *Gate IV* of ancient city walls.

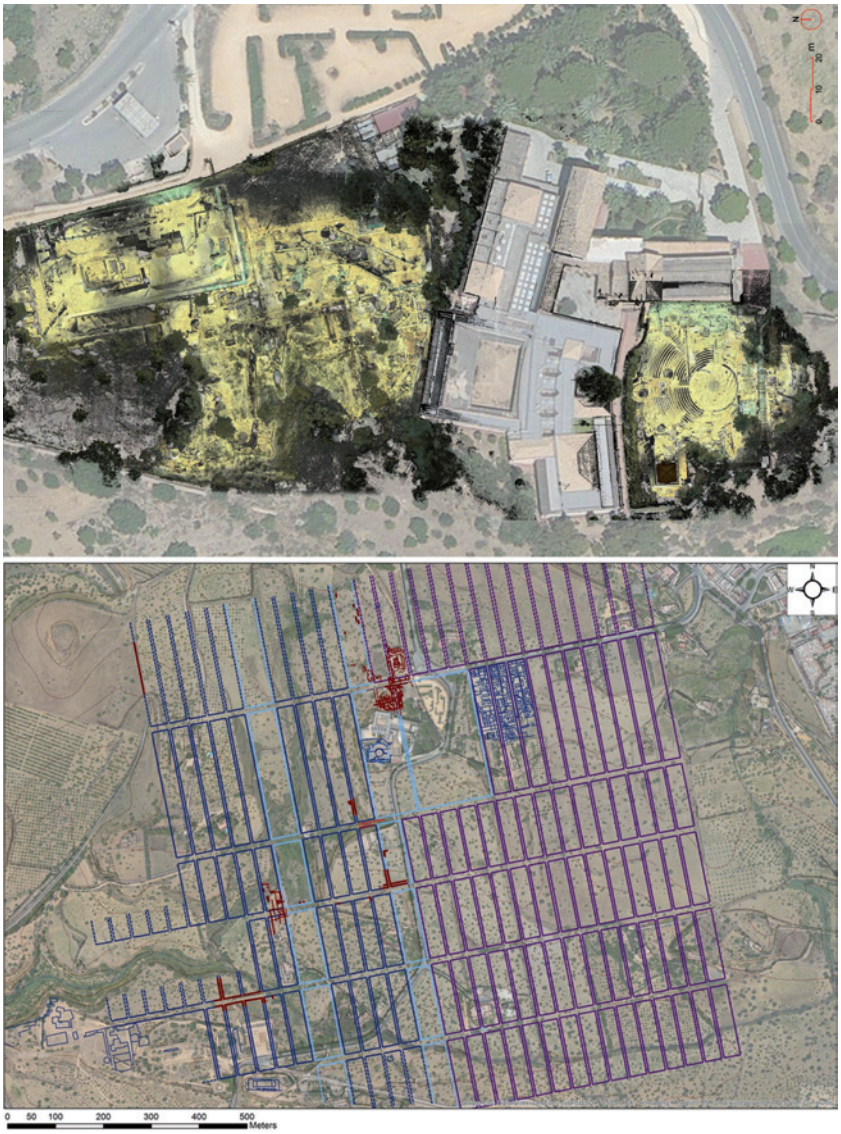

Fig. 1. Agrigento. Above, planimetric orthoprojection of the point cloud model of *upper Agorà* overlapped the ortho-photo. Below, the new urban scheme of the ancient city

Our research in the central quarter of Agrigento allows us to restore a new image of the ancient city.
The shorter blocks of the city and the extensive public areas connect the urban plan with several analogous cities built in Sicily in the same period. In this way, Agrigento can finally come out of isolation due to the misunderstandings of its previous reconstructed plan. The new city image gives the possibility to associate it to a well-defined group of cities founded by tyrants who, starting from the 480 BC, transform the Sicilian urban landscape. The urban patterns of Naxos, Camarina (Uggeri, 2015), Catane, Casmenai and Megara *Hyblaea* (Anzalone, 2012) combine two principal features: the orthogonality of the street pattern, which draws regular blocks of 35 m in width and 150 m in length, and the terraced monumentality. Research on Agrigento also aims at restore a virtual image of this city and its transformations from the late Archaic period to the Romanization.
Some aspects must be clarified first of all the shape of the classical city compared to the Hellenistic one, in order to understand the evolution of the urban system.
The realisation of the new urban grid was not only determined by the definition of the blocks, but also by the complex system of terraces since its early stages. Most likely, the system of roads has not been altered in the later stages, if not marginally. The urban scheme shows, however, that the few remaining fragments of V century city, such as the neighbourhood east *Olympieion*, were fully inserted into the urban pattern.

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Contributions From the Digitalization of the Archaeological Documents For the Study of the Northern Shores of the Persian Gulf (Siraf, Iran)

Fatemeh Johari

☞ PhD candidate in Archaeological Science, History and Art History
PhD School in Humanities, Università Degli Studi Di Torino, Italy

✔ KEY WORDS: Siraf, GIS Project, Database, Persian Gulf

ABSTRACT:
The port of Siraf, whose ruins lie beneath a small city, is located on a narrow plain, 250 kilometers southeast of Boushehr and 36 kilometers east of the port of Kangan. Having been the most prominent historical port of the Persian Gulf since the Islamic period, Siraf has been not only an ideal place for the exchange of goods between China and the Mediterranean but also an eminent centre for dialogue between civilizations, religions, cultures and traditions of different nations. However, this comes as no surprise considering that Siraf was located on the maritime Silk Road and that it represented one of the greatest meeting points of East and West. In recent decades, in order to determine the genuine dimension of Siraf, several terrestrial and coastal archaeological surveys and excavations have been conducted. During the past two decades, Siraf has undergone immense transformations due to some changes in the region. Thanks to our project that is still unfinished at this stage, a significant number of raster and vector layers originated from the digitalization of archaeological georeferenced plans have been produced with the use of cartographic resources and information obtained from aerial photographs and satellite images. These and other data from archaeological reports and historical sources have flowed into an archaeological database. The analysis of this material through some applications such as QGIS, Auto Cad Map 3D and Microsoft Office Access has supplied a wide, integrated and further developable basis to study the current conditions of the structures and to identify potential damaging and destructive factors connected to human activity and natural causes. This research is in fact the result of a PhD project supported by the Università di Torino.

Introduction

History and Topography of the Site

The port of Siraf was one of the chain ports on the northern coast of the Persian Gulf and it reached an extension of over 250 ha between the tenth and ninth century AD (Whitehouse, 2009). According to the written sources and also to the results of several archaeological activities, this port must have been considered as one of the most important commercial ports of the Persian Gulf during the Sasanian and early Islamic periods (Esmaeili, 2015). Located in the alluvial plains, it is characterized by highlands that slope gently towards the sea. Since this port was geographically defined by highlands to the north and sea to the south, the physical growth of the city took place along the coast and, more precisely, over a narrow strip of land 10 m above sea level, with a length of 4 km and a width of nearly 700 km. The area is characterized by moderate winters and hot, humid summers and numerous earthquakes have been historically

attested here, the most terrible of which is considered as one of the main reasons for the decline of the port in 976 AD. Until recently, the modern port sited over the historical port of Siraf was known by the name of Bandar-e-Taheri, just before being renamed Siraf once again (Fig. 1).

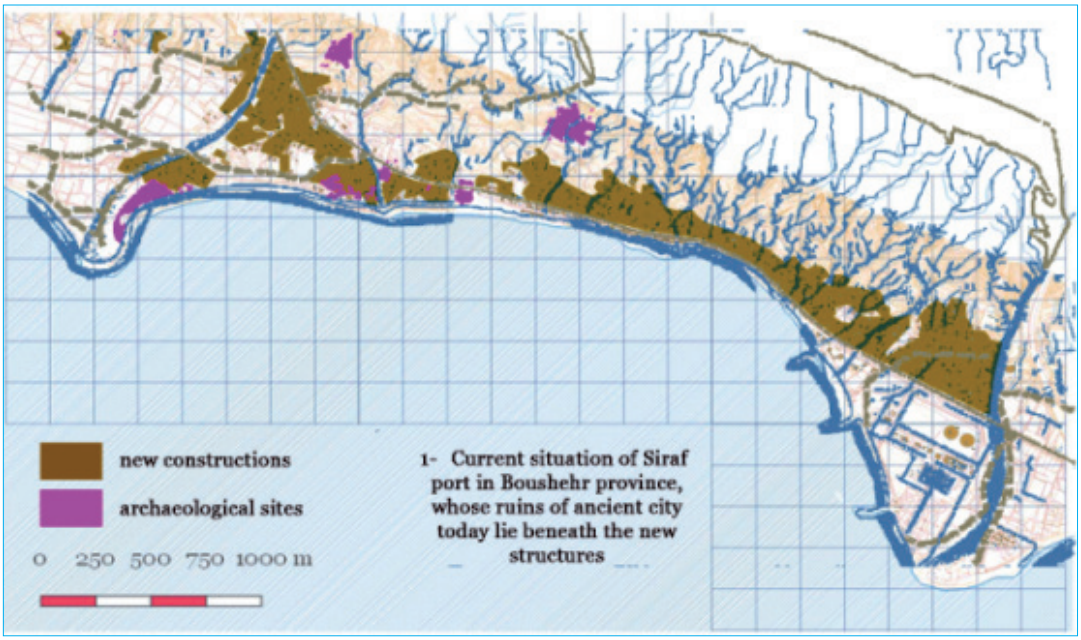

Fig. 1. Current situation of the port of Siraf in the Boushehr province, whose ancient ruins lie beneath new structures.

Background research

The history of research dates back to about two centuries ago. In spite of this, it should be underlined that even if the texts dating from the tenth to the fourteenth century superficially mention this glorious port many times, not much attention is paid to Siraf independently. Sir Aurel Stein visited Siraf in 1933 and he investigated the western area of the village of Taheri. He published the results of his observations in 1938. Dr. David Whitehouse, between 1966 and 1973 focused his archaeological activities on the area previously mapped by Stein but his studies covered also a space of about 3500 meters to its west and east (Aldsworth, 2005). The excavations were brought on by Dr. Bakhtiari, Dr. Ma'soomi and Dr. Esmaeili.

The Database and GIS Project

Research goals

Nowadays, buildings discovered as a result of archaeological excavations and historical monuments recorded in the list of the "National Monuments" of Iran can be seen as distinctive elements

of the landscape, characterizing foothills, the coast and even areas surrounded by new urban contexts. However, over the past decades Siraf has undergone fundamental transformations due to economic changes and other factors which have irreversibly damaged the historical urban fabric of the city. Therefore, it seemed necessary to analyze the current situation of these archaeological remains and the potential transformations in which they might have been involved.
The project was launched exactly with the aim of creating a database consisting of the geographical and written information made available by five decades of archeological activities and including also all the documentation related to the urban layout of the modern port of Bandar-e-Taheri. In a second phase of this work, the processed data recorded in the database were linked to the GIS, opening up the possibility of making queries as well as of obtaining new information from this integrated system. In the next paragraph I will present a brief description of the theoretical and archaeological approaches used for this project.

Methodology

At the beginning, an extensive study was conducted on the site. The aim of this preliminary research was to identify all the available sources, such as the cartographic material including urban and regional maps, topographical maps, archaeological survey maps and aerial photos. In addition, all the literary sources consisting of archaeological reports, articles and documents related to the site were recognized. It is worth mentioning that surveys and excavations have been implemented at different times by foreign and Iranian expeditions even if, prior to this project, no attempt had been made in order to gather and organize all the available documents and to create an integrated database and a GIS system. Therefore, the project took advantage of two different research methods, namely library and field studies in the region and the collection of information from natural and legal persons. After an initial review of the gathered data, there was a discussion aimed at identifying the best structure in accordance with the objectives and possible needs of different users. This phase was deemed necessary. In fact, although the greatest majority of databases with a focus on archaeological sites generally share the same principles, each archeological site has unique characteristics as a result of its geographical and climatic context, which need to be considered carefully. Hence, the creation of a database should be directly related to the nature of the site as much as to the state of the ongoing studies. This point is even more relevant for Siraf since its historical layers as well as its excavated buildings are exposed to new construction activities. Finally, all the necessary softwares such as Excel, Access, AutoCAD and QGIS were prepared.

Results

The database includes site and feature tables which contain several details providing useful search tools and representing the basis of a relational database (Fig. 2).

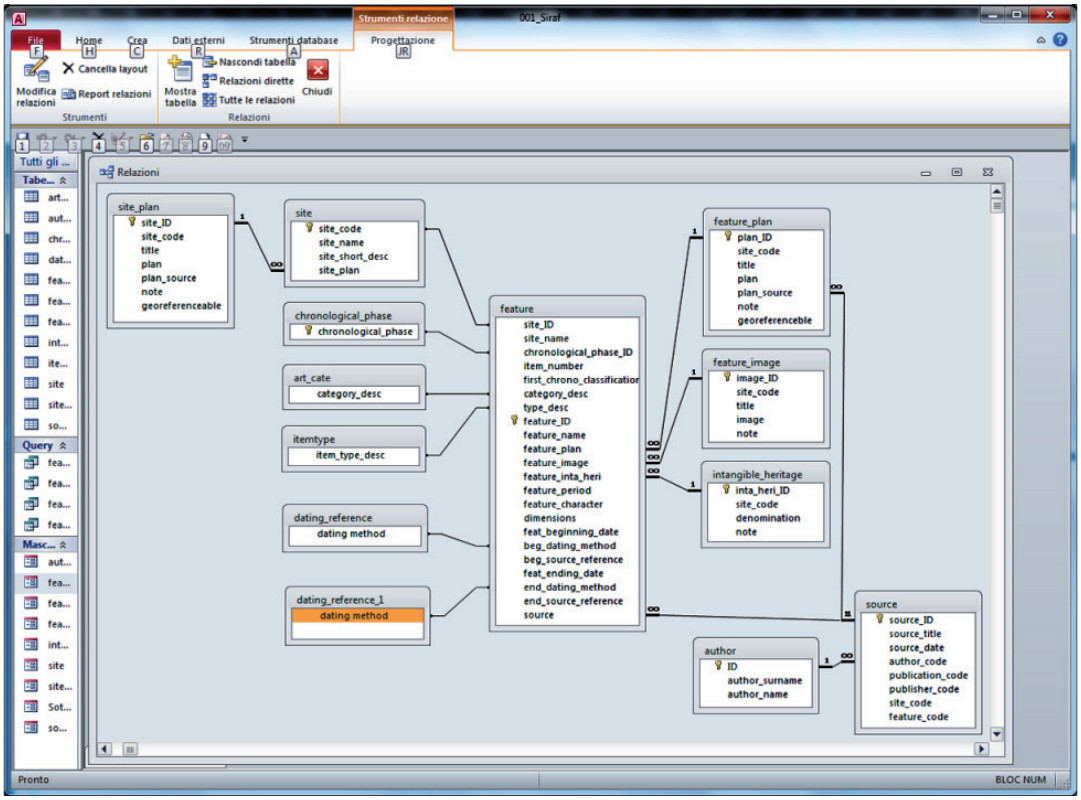

Fig. 2. Access relationship layout, the main structure for organizing information as a base for future activities.

Forms were designed and added to simplify the record of data and the research process as well. Objects or features were considered as base units related to each shape in GIS, so that each object could include time layers and the evolution of those shapes in time. These elements were defined by special codes (feature ID) during the encoding process of the database. The codes that act as primary keys were considered as unique tools to identify both each item in the database and its feature in GIS, so that duplicates could be avoided. Each feature form is inclusive of information such as feature ID, site name, feature name, chronological phase ID, item number, category, type, image, plan, dates and description (Fig. 3).
"Category" and "type" can also be used as search fields and they are useful to recognize the function and typology of each feature. The date field is meant to specify a chronological frame in accordance with the Gregorian calendar and with the possibility of adding other calendar types such as the Hijri or the Solar calendar. In this context, the word "site" refers to a vast area characterized by several objects or features. Each site form in turn includes many items such as site code, name, descriptions, plan, information about the archeologists responsible of the excavations, site type, eventual lootings, intangible cultural heritage, related sources of data etc. (Fig. 4). It should be noted that site codes play a key role in the identification of each site. After the construction of the database, information were registered on it. It was a diffi-

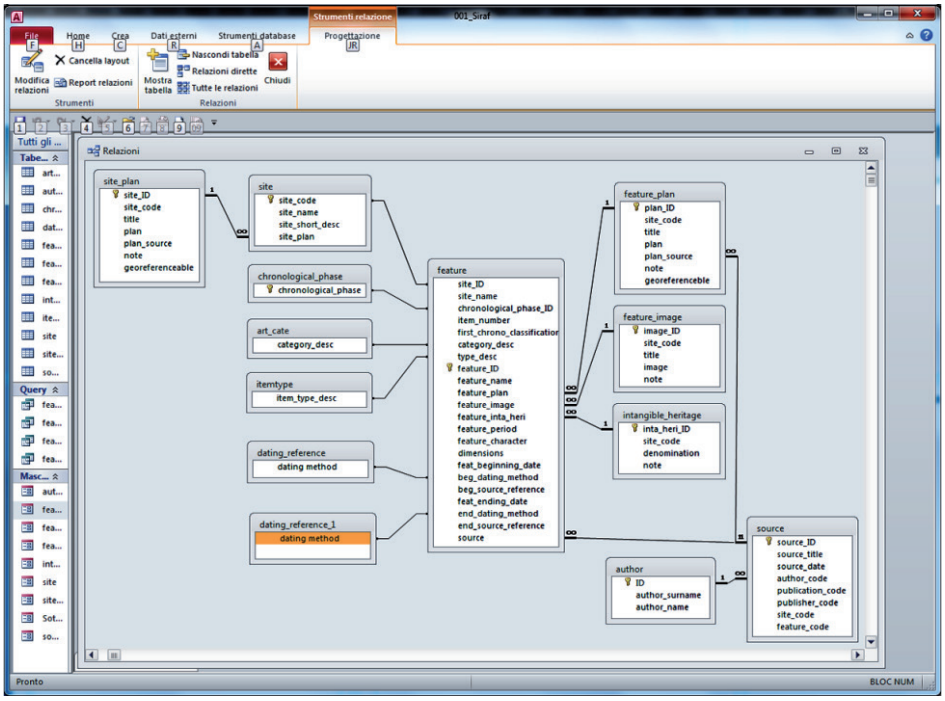

Fig. 3. Access feature form, consisting of all the useful information about every feature of a site.

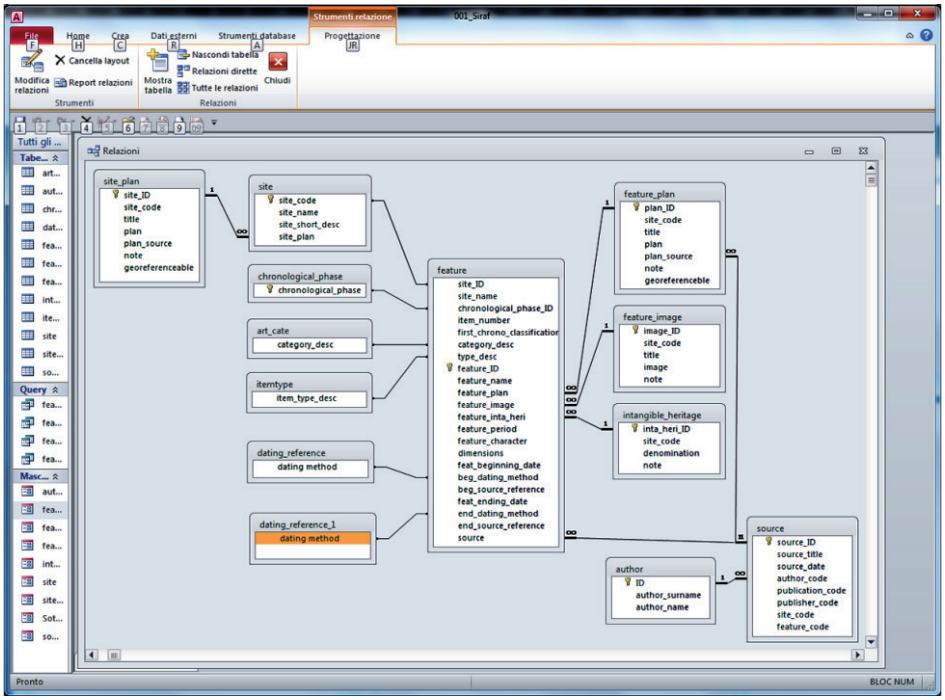

Fig. 4. Access site form consisting of all the useful information about each site.

cult and time consuming operation and it was performed on the database and GIS in parallel, because the functioning of a practical database such as this depends on the way in which the database tables and the GIS layers are defined and put in relation with each other. This applies even if not all the database tables are connected to a specific GIS layer (such as the historical source table) since some of these tables consist only of written information. Before entering data into the database, it was necessary to translate part of the information from Farsi to English, considering that some of the archaeological reports and literary sources were published in Farsi, while the database is set in English.
The process of entering data in the GIS was accompanied by the creation of the exact bases to georeference the raster files so that all the plans could be related to the different phases of construction of each historical building in every single site.
The work on the vector files proceeded by processing different layers such as shape, point and line directly or by extracting them from data sources. During this simultaneous operation, the database was tested to avoid potential issues.

Discussion

The GIS project I briefly presented is aimed at analyzing and organizing the information obtained from archaeological surveys and excavations in the most appropriate and convenient way. Archeological layers were selected as a central element along with the buildings associated with them. As a result of the chronological analysis of the stratigraphy and also of the spatial and distributional analysis of the data collected on the site, it is possible to achieve a deeper understanding of the nature of the buildings scattered in different areas of the city. For example, studies focusing on the urban layout and on the historical evolution of the city are now feasible.
Therefore, this system not only allows an accurate registration and elaboration of the data, but it favours their reinterpretation as well. In order to perform further analysis, all the changes involving the site in recent decades were recorded and measured carefully (Fig. 5). One of the objectives of this project was to elaborate thematic maps such as the ones related to the excavations conducted by every single archaeologist, chronological maps representing the evolution of the city in time and distribution maps signaling the concentration of buildings with the same function in different areas of the site, etc. Each one of these thematic maps is easily accessible through a simple research on the integrated database and GIS system.
Furthermore, there are strong reasons to believe that the reliance on both the database and the related GIS for future surveys and excavations will enhance the speed and accuracy of the research.
Focusing on the spatial information concerning a defined area and its surrounding landscape, then, new horizons are opened for an archaeological interpretation of the ancient city in its context. It has to be specified, though, that owing to the incompleteness of the project at this stage, it is still possible for users to improve the structure of the database and to implement

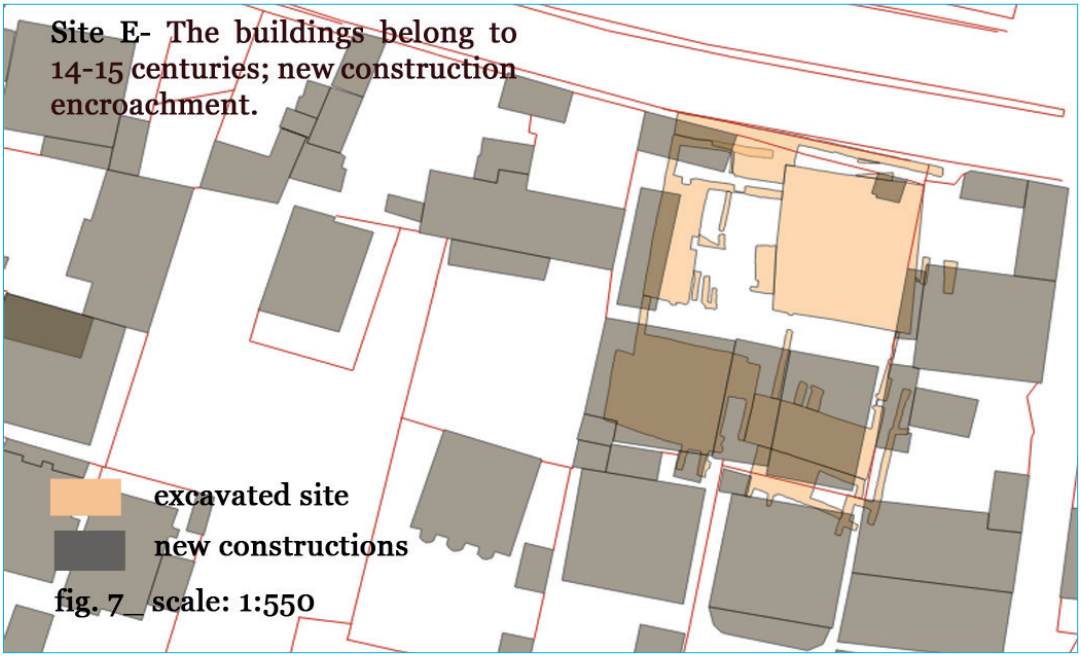

Fig. 5. Buildings dating to the 14th and 15th century covered by a new construction.

it, for example by adding new words and definitions as well as cartographic data. The system, in fact, supports the combination of data resulting from researches conducted in different periods.

In conclusion, it should be noted that because of the use of sources of diverse nature, and of various software programs, many problems have been faced since the beginning of the project. Even the data entry was extremely complex since it was necessary to concentrate the information with an emphasis on the scientific terms and to standardize each document without losing its internal connections. Therefore, selected keywords were established in order to communicate and share information, allowing a well-structured integration of data.

Future goals

Among our future plans I must mention the expansion of this project in the 3D environment and the implementation of our work on the intangible heritage, which has already been prepared by creating specific forms that will be filled in with pertinent information. A further step towards the improvement of the database will be made by sharing it on the Internet in the easiest and most controllable way. We are also considering the expansion of this database to include scientific information about other historical ports located on the northern coast of the Persian Gulf.

Acknowledgements

I would like to thank the Bushehr Office of Cultural Heritage and Tourism, the Iranology foundation-Bushehr office, the Iran National Museum and the Siraf-Pars institute NGO, the department of archaeology of the University of Turin and in particular Dr. Lippolis. Finally, a special thanks to engineer Antonio Barrocu from the University of Turin for his uninterrupted help and friendly companionship during the project.

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The Classical Theater and its Material Culture: the Case of Lipari's Masks

Francesca Fatta, Manuela Bassetta, Andrea Manti, Andrea Marraffa.

☞ Department of "Architettura e Territorio", Mediterranea University of Reggio Calabria, Italy.
ffatta@unirc.it, manuela.bassetta@unirc.it, andrea.manti@unirc.it, andreamarraffa89@yahoo.it

✔ KEYWORDS: Theatrical Representation, Classical Theater, Photo Modeling, Masks, Edutainment.

ABSTRACT

The investigation of classical theater, during the Magna Graecia and Roman's age, is a topic widely known and examined under many points of view. That which still turns out to be inadequate, it's the relationship of theatrical spaces with the whole aspect of the theater art, the intangible heritage under the architectonical and landscape profile, and also what is intangible for the history, transformations and projections towards the development of the modern theater and perspectives of new possible innovations.

The complex system of theater, composed by decorative sculptural groups that formed the frons scenae, the periaktos, the scenic machines and the masks, of which only fragments and tracks remain, today not contextualized in museum set-up or antiquaria represents a kind of "archeology of the show's machine".

In this context, we want to underline how the project of safeguard and valorization of the historic equipment can raise the evocative strength of the theatrical architecture, enriching the path of visit and making it even more usable and clear.

Introduction to the research

The investigation of classical theater, during the *Magna Graecia* and Roman's age, is a topic widely known and examined under many points of view, by archaeologists, architects, specialists, historians of the architecture and of the theater. Unfortunately, what still turns out to be inadequate, it's the relationship of theatrical spaces with the whole aspect of the theater art, the intangible heritage under the architectonical and landscape profile, and also what is intangible for the history, transformations and projections towards the development of the modern theater and perspectives of new possible innovations.

The complex system of theater is composed by decorative sculptural groups that formed the *frons scenae*, the *periaktos*, the scenic machines and the masks, of which only fragments and tracks remain, today not contextualized in museum set-up or *antiquaria* (like for example the archeological museums of Lipari, Locri, Reggio Calabria, Medma, Tindari, Palermo, Siracusa). This heritage represents a kind of "archeology of the show's machine", formed by an *unicum* between architecture and scenic instruments: the historians describe it as "the material culture of theater".

In this context, we want to underline how the project of safeguard and valorization of the historic equipment can raise the evocative strength of the theatrical architecture, enriching the path of visit and making it even more usable and clear.

The modern archeological researches, from Winckelmann till today, allowed a detailed comprehension of old artifacts; the modern survey techniques stretched out the representation's

borders, showing pre-existence, essays of virtual reconstruction, projects of restorations and reuse. A documentary opportunity that has to be further integrated and addressed to purposes of communications and valorizations of theater as state of knowledge, defense, communication and show.

The place of the research

The Archeological Museum L. Bernabò Brea of Lipari contains many examples of reproduction of masks in miniature, that the actors used to wear on their faces during their acting to interpret the different designed roles, also female ones, ascribable to the theater genres (tragedy, satiric drama, comedy) of the great repertory from the IV to the III century B.C. and in this circumstance we want to present the survey, the modeling and the prototyping of same important sample (Bernabò Brea L., 1998, Bernabò Brea L., Cavalier M., 2001).
The purpose of this research is focused on the implementation of a multimedia section for the study of theater and of the classical representation, through AR and VR systems, prototyping of models also for blind people. The prototyping could be addressed both to their new interaction in theatrical contexts and in museum and didactical field. This path of research opens out in a scientific and educational field with a touristic vocation and oriented to the entertainment. A first important consequence concerns the use by a generic public that, thanks to the digital instrument for the augmented reality and the using of interactive Apps, could know virtual models and audio-visual archives dedicated to the "material culture of classical theater", to present again, in a different way, the theatrical places. Instead, for an expert audience we want to think again the places of classical theater, related also to the contemporary theater, for the comprehension of the whole scenic and scenography set-up, and for their using in the performance arts.

Fig. 1. *Oulos neanìskos* (semi-frontal and profile), the curly-haired young guy: points cloud computing on Agisoft Photoscan. *Pollux* said that this is the youngest 'character', suntanned, who raises the eyebrows and has not just one wrinkle on his forehead. Intact sample, even in the color with a big hole on the forehead. Inv. 6766, from the 376th grave; M.T.L., cat. 3, fig. 267, tab. XXIX 2.

Fig. 2. The *Pseudokòre*, the false virgin (semi-frontal and profile): points cloud computing on Agisoft Photoscan. This mask represents a family girl who had some adventures, generally during a night party, when the plentiful libations weakened the self-control. There are many in Menandro, Plauto and Terenzio's comedies. She looks like to a bride, overdressed, with a polished hairstyle, prepared for the event, mark out by a tress that surrounds the head. Inv. 9762, from the grave of the XXXII pit; M.T.L. cat. 1; fig. 364, tab. XXXVII.

The actors of the research

This paper is the result of a beginning of research in partnership between the Mediterranean University and the Management of the Museum L. Bernabò Brea of Lipari (ME)[1]. During the latest agreements, we have decided to verify the potentiality of the modeling and 3D printing's method that, going beyond the mere phase of reproduction, can reach to an anastylosis and to the reconstruction of missing parts of some fragmentary sample (of some not yet exposed artifacts), published or not, about the various type of masks. This extension of the catalogue will allow us to understand the old production techniques, to verify the belonging of this fragments to common prototypes, and their making with matrixes of different generation. Thanks to the modeling and the prototyping, we could verify the theory showed in recent researches about the different methods of a serial making of for our masks, from the Classical age till that Hellenistic. This models could be used for the realization of a combined project, able to fit it the Museum of useful material for the study and consumption of art by blind people and finalized to the "edutainment". The archeological competences, given by the management of the Museum (M.A. Mastelloni) and the technical-scientific experiences of DiMoRa lab (represented by F. Fatta) of the d'ArTe Dpt. of Mediterranean University of Reggio Calabria, are coordinated though an integration of knowledge, to specify and qualify the innovative sense of the research.

Typology and morphology of the masks: the case of Lipari

During their archeological campaigns in the Greek necropolis of Lipari, L. Bernabò Brea and M. Cavalier discovered a huge number of evidences in clay, specified by the literature as ter-

racotta-masks of theatrical subjects (Bernabò Brea L., 2001). Their production started from the IV century to the first half of the III century B.C. It represents the wildest, the richest, and the oldest collection concerning the theater. It includes all of the drama genres: from the tragedy to the satyric drama, from the Middle comedy to the New one of Menandro. (Fig.1)
The masks, maybe made by the genius of only one atelier, were discovered in many grave grooves: it is obvious their relationship with the esoteric-funerary worship of *Dyonisus*, God of theater, of the symposia and of the funerary ceremonies.
At first, the masks have been interpreted as a reproduction of real masks, exported from Athens to spread the theatrical art in whole the Greek world (Mastelloni M. A., 2015). They traveled in packing cases maybe linked with their drama texts.
The masks have been divided in 3 different groups. Those of the first groups, with restrict and constant dimensions, were made with a fine and of good quality clay, pressed in double matrixes. After a first baking, they were covered by caolin, then painted and baked again to make the color permanent. The skin tone of the male masks was dark brown, light for those female. The mane and the beards were generally represented with stripes.
Almost all the masks present a suspension hole, because they were hanged up as *ex-voto* to *Dyonisus*. This links the masks to the "material culture of theater", because when they were not used anymore by the actor, they became archeological details and decoration for walls, or instruments used during ceremonies and funerary rites.
One of the main feature is the great skill of the artisans to suggest the realism of the different characters, with the aim to plastically make the profound conflict of the feeling of each one. For example, in the tragic masks, the character are typified by an astonishing realism which freezes them to the moment of climax, during the drama. Admirable are the examples of the masks of *Philoctetes* and of Paris, but also those of Oedipus and of *Jocasta* (Allard G., Lefort P., 1984).
From the start of the III century B.C., started to spread in Lipari a new typology of masks, corresponding to a different catalogue. A new and intensive production supplants the precedent, maybe coming out from the repletion of samples deduced by old matrixes. But it changes also the technique of making of, the type of clay, the painting and the baking. Maybe it also changes their end use: they still continue to preserve their theatrical use, but the terracottas become sculptural and architectonic supports used during celebrations. This kind of mask will remain the same from the pre-Hellenistic period till the Imperial Roman Age. It's a huge index (almost 350 pieces, complete or in fragments), that covers all the genre of the "new comedy", widely described by *Julius Pollux*[2].
Between the 44 masks enumerated by *Pollux* there are 9 old men, 11 young men, 7 male slave and 17 women. These masks reproduce characters-type well known and widespread. Also in this case it's amazing the temperament that come out from each masks, the fineness and the naturalness that distinguish the psychological profiles of each type. (Fig.2)
As Jean Pierre Vernan said: «A mask is a transfiguration, a metamorphosis, a change from a shape to another. The mask is a instrument of possession. It wraps the man who wears it. It closes off and immobilizes him. Wearing a mask means taking possession of a new face, conforming it to our own behavior and transforming it in another one, in a magic illusion, an unknown journey»[3].

Fig. 3. Archeological Musem of Reggio Calabria: digital survey of a mask (maybe 'the old slave') founded in the archeological area of the old Rhegion. For the survey we used a measuring Arm FARO ScanArm, a perfect non-contact measurement system. deal for product development, inspection, and quality control and offers capabilities such as point cloud comparison with CAD, rapid prototyping, reverse engineering, and 3D modeling of free-from surfaces. Accuracy- ±25µm (±0,001in) Scan rate- 280 frames/second, 280fps x 2,000 points/line = 560,000 points/sec

From three-dimensional survey to data communication

To the state of the art and technological development for a better match between the real artifact and the geometric model, obtained by instrumental data acquisition and provided by the three-dimensional survey (De Luca L., 2011).
In Fact, the possibility of acquiring which offers a 3d laser campaign is still incomparable both for accuracy and metric reliability, as well as relatively fast at least during the acquisition phase. (fig.3) At this technology, already applied to the documentation of Cultural Heritage for several years was accompanied recently the possibility of reconstructing three-dimensional scenes, or objects, starting from digital photographic images with the additional benefit of associating the strict morphological and geometric documentation, also a high detail photorealistic restitution, that gives essential information during study of material and chromatic quality.

The SFM procedures are now integrated in the main photo modeling programs they arise in the context of Computer Vision such as a rapid, low cost and easy to use tools, able to generate dense clouds of points from photographic images. Although these techniques are born with the main objective to return photorealistic visualizations of the objects represented, some research carried out in the field of Cultural Heritage by the research group to which the authors of this article belong, they have verified the reliability from the metrical point of view through a series of projects completed during the past two years.
In the specific case of clay theater masks, starting from a limited number of frames, the SFM program has reconstructed a faithful model of the object and with a high detail textures, optimizing the time needed for post-production and making easily manageable and viewable the model itself.
For each photographic session, the acquisition mode has foreseen manual settings of the camera used (Reflex NIKON D7100) to avoid an automatic setting of ISO values, that would increase the noise phenomenon in images, and constant opening of focal distance and diaphragm, which they were kept unchanged in in within the same shooting set (Fatta F., De Luca L., 2014).
Particular attention was paid mainly to the color fidelity and to the elimination of environmental color casts caused by artificial interior lighting presence.
Once processed images they have been developed using the software Agisoft PhotoScan that, through a series of subsequent steps, has led to the generation of the polygon model of each single mask, first tracking down the homologous points between consecutive frames, reconstructing subsequently a dense cloud of the photographed object and finally the matching textured polygon mesh.
The matter, the colors, the light reflection, the opacity of materials, contrasts of light and shadow are derived from mathematical models that perform a process which, starting from the real object to the derived 3D model can be used in other workflows, from virtual reality to the realization of a file STL, valid for 3D printing, which is an irreplaceable vehicle in the transmission and processing of information.
Immersive reality, augmented reality, virtual configuration hypotheses of damaged or missing objects, organization of information systems, are some of the possible applications that can allow more efficient methods of analysis for the insiders.
There is nothing more unreal and impalpable of images produced by a computer, that thanks to the rapid prototyping tools have the opportunity to become a concrete form. (fig.4)
A "duplication of the real" that mixes together rigid algorithmic formulas with the subjective process of interpretation by the detector, where the technical equipment reduces the margin of interpretive error, but do not negate the subjective mediation processes. The result that derives is no longer a simple duplication of the objective referent, but an interpretation that changes appearance to changing purposes.
If the goal is the replacement of an object temporarily missing for enjoyment by the, museum visitor then the color fidelity becomes prominent element in generating of the model and prototype. Without prejudice to each survey, and the prototype that ensues, derives from an interpretation in which multiple variables functions involved: lighting conditions, instrumental constraints, limitation of software, detector subjective perception.

On the contrary, the purpose of the prototype will be the fruition by blind or visually impaired obviously the color match became secondary and will need to focus on a perfect formal correspondence. (fig.5) The instruments that will be used in the two cases might be different: in the first case it will be sufficient to use photo-modeling processes that faithfully reproduce the texture, but allow less formal precision; in the second case you will need to use laser instruments with degrees of precision in the order of some tenths of a millimeter. The new digital instrumentation raise the question of the relationship between camouflage image and analytical representation. A theme with ancient roots that the mimetic replication capabilities made available to the relevant modern techniques make it even more relevant today. The IT tools and graphics processing mode that modern technologies allow can afford the implementation of innovative experiments useful to communication and dissemination of the archaeological and cultural heritage of the Museum.

Notes

[1] Learning Agreement, port. 1224, on june the 28th 2016, people in charge F. Fatta (Unirc) and M.A. Mastelloni (Archeological Museum of Lipari).

[2] Encyclopedic glossary about masks, contained in the Onomastikon, IV, 133-154.

[3] Jean Pierre Vernant, "Le racisme, mithes et sciences", Paris.

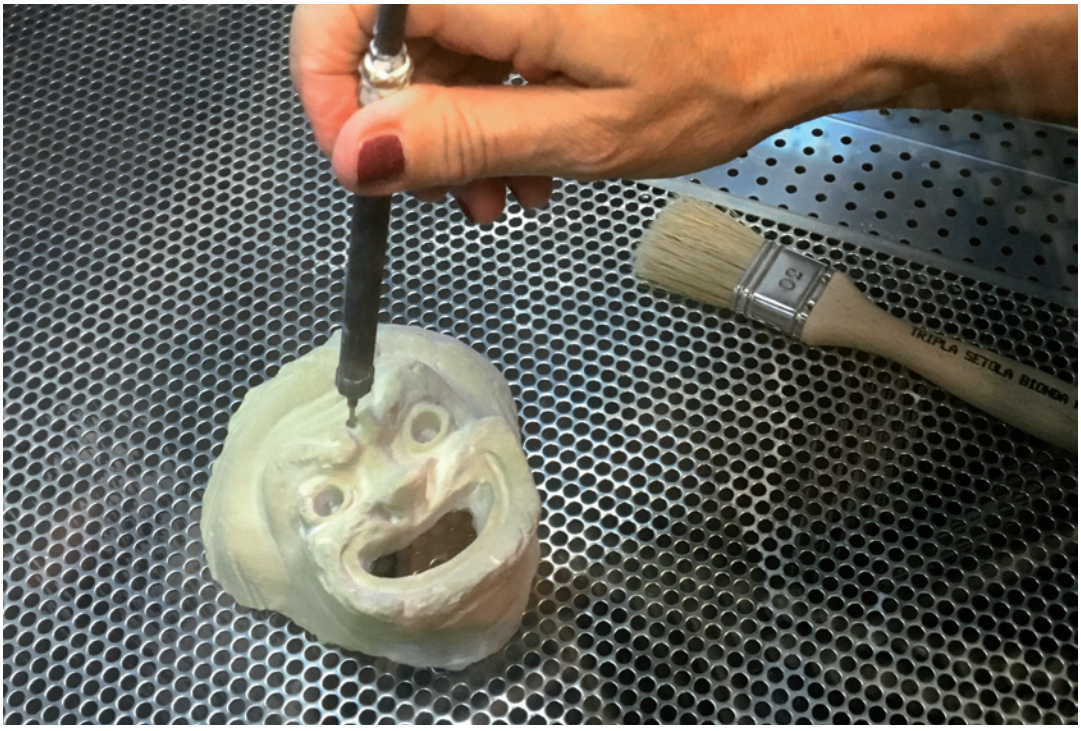

Fig. 4. 3D printing of a terracotta mask (thought ProJet 660 Pro) maybe the Old Slave, founded in the archeological area of the old Rhegion. Prototyping of the digital model and removal of the overage powder though an air-compressor pen

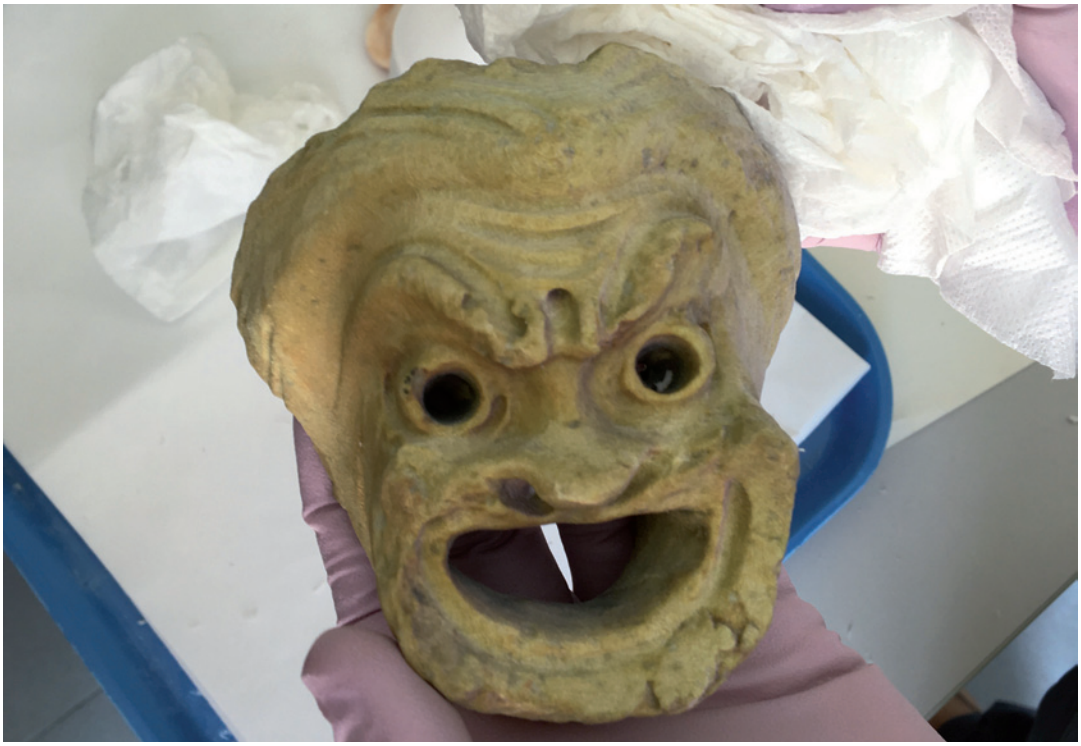

Fig. 5. 3D printing of a terracotta mask (thought ProJet 660 Pro) maybe the 'old slave', founded in the archeological area of the old Rhegion. The printer incorporates professional 4-channel CMYK full-color 3D printing to produce exceptional high-resolution models. All models produced can be sanded, drilled, tapped, electroplated and have high temperature resistance for use in molding.

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The Acme of a Complex Cultural Interiority: How to Resurrect and Redesign an Ancient Town

Giacinto Taibi, Rita Valenti, Concetta Aliano, Emanuela Paternò

☞ Architecture SDS, University of Catania, Italy giacinto.taibi@gmail.com_ritam.valenti@gmail.com_luana.aliano@alice.it_patermanu@hotmail.it

✔ KEYWORDS: cultural landscape, 3D modelling, archaeology

ABSTRACT

Today more than ever our inner self cannot be silent in front of the basic need to unravel the knotsand solve, in the best possible way, all the difficultiesfound in the historical setting and in the definition of the typology of system which contains the "modus" to make accessible, in a sustainable way, the archaeological heritage of our country and the achievement of a necessary and profound balance, concerningthe reality of the town which confronts the multitude of explorable archaeological finds. The primary objective is to adopt a global approach towards the archaeological finds, in all their complexity of scale and conservation, as if they were documents and writing to decode with the support of 3D reconstructions. The research moves in this direction.

Introduction (G. Taibi)

In the general context, our research is committed to the discovery of past knowledge. Our aims and objectives are to win the resistances and to overcome the obstacles in order to disclose and reveal the mystery, following a progressive line, today supported by specific technological innovative instruments. It is also of great importance to know that only with proposals worthy of scientific and technological innovative contents, it is possible to preserve the memory traces and the roots of our own past and to better understand artefacts of non invasive types, in order to hand it over to the future generations so that the place and its revaluation can be considered in relation to the precise structure of the ancient tracks. The anthropization of the Aretusean landscape, which goes back to the IV millennium, bears the signs of a multistratified and polymorphic past whose features outline a harmonic and continuous dance among the treasures of Mediterranean art and archaeology. (Fig. 1)

A precise and complete review of all significant data relating to the precious archaeological, artistic and architectural heritage, deserves to be accompanied by an initial consideration about what the connection between the modern town, meant as a "cultural centralization" place, and its own historical past can be in view of a better synergy among institutions with different competences and with the sole objective to preserve, enjoy and disseminate culture. "A tenacious life impossible to subdue" is the literary image underlying any reading activity and any comprehension of the material traces of our past. In such a way, the dialogue between architecture, archaeology and history of art becomes tight in view of an integrated reading

Fig. 1. The archaeological landscape: "Temple of Apollo" and "Roman Pool". Images processed by the Laboratory of Representation, University of Catania.

of the archaeological heritage according to the ancient tracks which made the Pentapolis an extended settlement. The present study I started from the survey carried out in the city of Syracuse exploring its architectural routes within its famous archaeological heritage from the reconstruction of the Neapolis areas and from the finding of the ancient track of the Via Sacra, the Sacred Road, the Cardo of the Aretusean town.

The digital documentation for the reconstruction of matter and history (R.Valenti)

The context of the present research is deeply related, according to some dynamic and complex dialectics, with landscape archaeology, urban archaeology and archaeology of architectural stratified artefacts; the analysed fabric is the result of chains of successions about historical experiences to decipher through a careful interpretation of the signs which can refer to other similar domains in relation to time.In particular, the analyses, carried out on the basis of a precise survey and with the help of literature and archive records, aim to compile a 3D digital documentation for the virtualization of the reconstructive process of the archaeological heritage.
The use of the latest generation high-performance systems allows data access which facilitates the interpretative, storage, consultation and dissemination stages of the survey products, especially when the material we are dealing with is made up of broken and corroded ancient fragments.In line with the methodological principles expressed by The London Charter about virtual archaeology – rigour of researched sources, identification of the technological instruments and of the logical process reconstructions are based on – the present study turns out to scientifically and intellectually rigorous digital modelswhich take the role of visual documents, fundamental for the understanding of the archaeological finds and for the dissemination of culture.
The representation and communication of Syracusan architectural heritage is specifically concerned with the research of forms and proportions through the evocative virtual simulations not only of the absent matter, but above all, of the conformative process, taken backwards, which in the course of the different historical phases gave rise to the present urban and architectural setting.
Hence, the process of digital visualization of hypotheses is applied with an explicitly accurate clarification of the methodological stages of interpretation so that the objective work of restitution and the interpretative analysis with the relative benchmarks will always be distinctive.From the operative point of view, the study has taken into account two archaeological contexts with different basic features; thereby the research, using the same approach, has produced appropriate virtual restitutions related to themes arising from the examined archaeological object, in search of a visual balance between analysis and synthesis.More specifically, two conceptually different forms of modelling have been produced, deriving from a common objective methodological basis: the measurement process through "active sensors" of the preserved matter at the current state. (Fig.2)

Fig. 2. Syracusan archaeological heritage: the measurement process through "active sensors". Images processed by the Laboratory of Representation, University of Catania.

In the first example of the reconstruction of the Temple of Apollo on the island of Ortygia, the produced digital documentation is a reconstruction of the temple from the modelling of the survey data through triangle meshes. The initial level is supported by a stratigraphical objective survey and starts the subsequent modelling of the reconstructive hypothesis in the same way as a material restoration. The second example refers to the Roman Pool in the Archaeological Park of Neapolis, in this case the digital reconstruction conveys hypotheses and researches arising from the careful reading of the survey. In both cases modelling effectively contributes to the dissemination of the studies carried out, creating narrative scenarios capable of arousing interests to non professionals as well.

3D acquisition as the process of extracting knowledge for virtual reconstruction (E. Paternò)

In order to obtain the correct and complete representation of an object we often use the process of reverse engineering, the term is often connected with the material and/or digital reproduction performed backwards that is from the extracted information from an already existing object. It is a process of extracting knowledge based on the acquisition of information through innovative technologies allowing a better understanding of the original physical model. Despite the adopted objective technology, it is indispensable, especially in the present case, the contribution of the operator who, thanks to his/her professional knowledge, is able to fill all the possible gaps in the survey through an interpretative and reconstructive process. In particular, the research would like to consider methods, procedures and instruments used in the field of virtual reconstruction aiming at the enjoyment of the cultural heritage and its valorization. Emphasis is given to the need to carry out a "digital" reconstruction of the matter moving from the scientific data related to the archaeological area of the Temple of Apollo obtained with laser scanner technology.
Laser scanning surveying, together with traditional survey, allows the study of the site of interest and the collection of scientifically precise data used for descriptive and reconstructive representation. The great extension of the surveyed area required a survey campaign made up of several scans; the assignment of target coordinates in the Georeferencing process has made possible the combination of the various scans in the post-processing stage giving as a result a point cloud containing information about the three coordinates X, Y, Z. The discontinuous model obtained has been exported in the format xyz which allows the storage of RGB data contained into the original point cloud. Subsequently, we used the "Geomagic Wrap" software which can open .xyz files to transform the point cloud into a continuous surface through a generation of triangle meshes.
Finally, the obtained model has been converted into the ply format and been imported into Rhinoceros. The study so far developed, supported by an accurate historical investigation, has allowed the virtual reconstruction of the missing parts. Moreover, it has been possible to distinguish the objective parts from the interpretative ones applying a transparent texture to them. (Fig. 3)

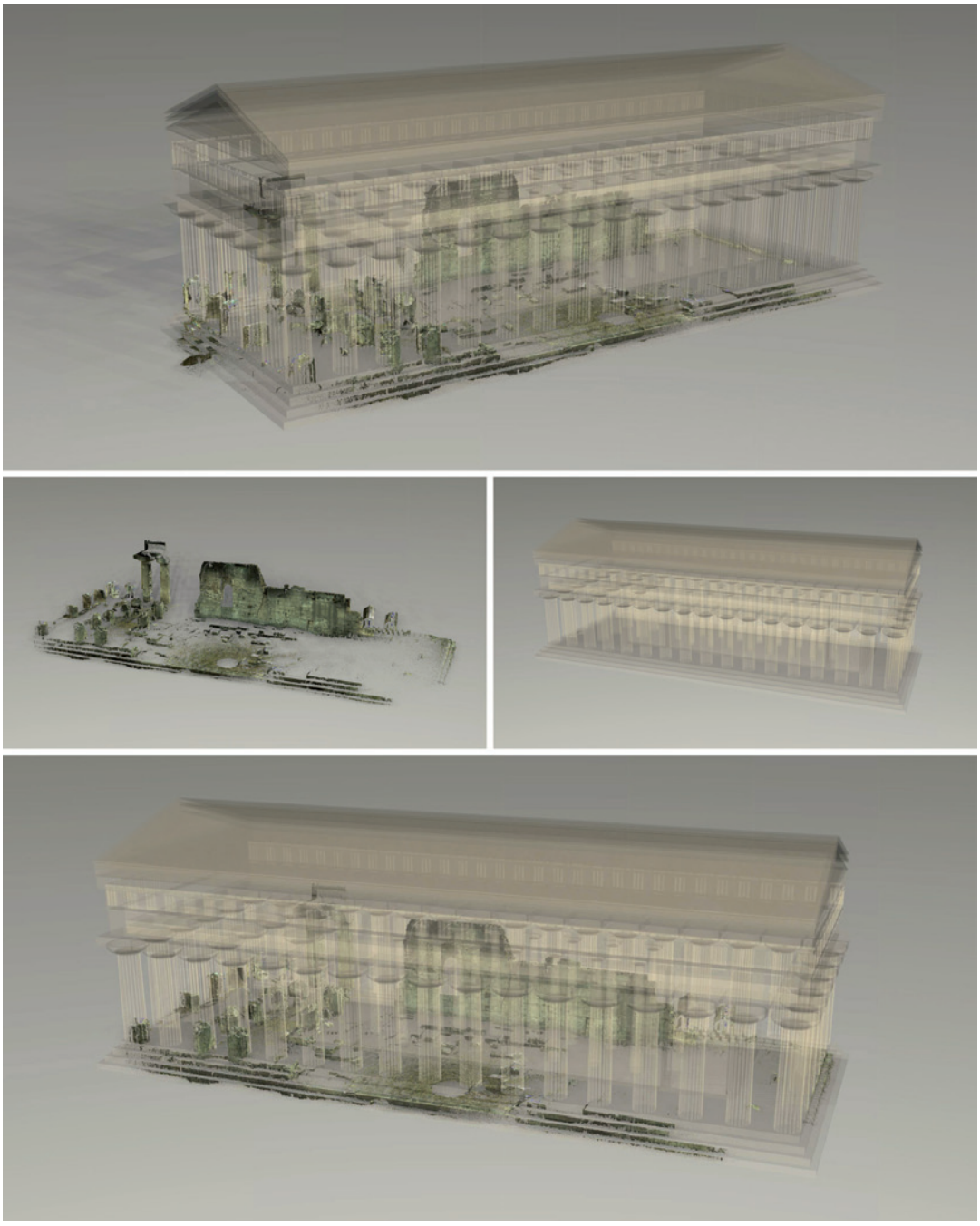

Fig.3. Temple of Apollo: stratigraphic objective reality and reconstructive hypothesis. Images processed by the Laboratory of Representation, University of Catania.

In the digital era we live in, reverse engineering process makes it possible to reproduce digital copies of archaeological sites, architectural buildings and works of art which can be used as exact forms of documentation, metrically coherent with the originals. In particular, research is oriented towards the acquisition, modelling and management of cultural heritage in digital form within the virtual archaeological, architectural and artistic heritage.

Virtual modelling and historical reconstruction (C. Aliano)

Human and urban landscape represents the inseparable connection between past and present. The cultural traces preserved in it offer a big research area which cannot, as a whole, leave out a historical and archaeological approach. "A tenacious life impossible to subdue" is the literary image underlying any reading activity and any comprehension of the material traces of our past. The present context of investigation has the primary objective of presenting a global approach towards the built environment in its complexity where the historical buildings become similar to written documents we have to decode. The dialogue between architecture, archaeology and history of art becomes tight in view of a stratigraphical interpretation of the architectural product. The virtual reconstruction of a monument represents a fundamental step for the comprehension of the constructive stages, the modifications occurred during the monument life cycle and its different uses and functions in the course of time which, often hidden in historical and archive records, conceal important elements of research for a tout court restitution. The present study focused on the case of the so called "Roman Pool", a small architectural jewel located within the Archaeological Park in Neapolis, Syracuse, made up of two adjacent areas, an epigean church probably of Norman origin and a hypogean chamber, multi stratified and with different mixed-use patterns: access road into the area of the Syracusan Theatre in the Greek period, basin for the collection of water in the Roman period, place of worship during the Middle Ages and finally common grave as far as the XIX century. The virtual 3D reconstruction of the site has increased our knowledge about it, facilitating comparative studies, the restitution of its life cycle and a better focalization of the reconstructive hypotheses provided by various authoritative experts. Virtual investigation has made possible, even if at a first critical examination stage, not only an analysis of the monument development but also a first comparison with its current state, highlighting analogies and differences. 3D visualization has allowed a better perception of the urban element, how it has looked like from Greek to Modern times, opening an interesting scenario of analysis about the strong communicative connotation within its virtual replication. A non secondary objective of investigation is to question about what type of relation the modern city of Syracuse has developed in the course of time and is still developing with its "overpowering" archaeological heritage. In line with Salvatore Settis' position (Settis 2004) about the "three ways to confront Antiquity, Continuity, Distance and Knowledge", we confirm that the immediacy of virtual reconstruction fosters the immediate perception of the monument becoming a powerful accelerator for the assimilation of historical concepts even for a non

specialist audience. In this way, the study of the Ancient world will deal not only with the Past, it will also focus on the Present and the Future, as a motivation for the comprehension of our cultural roots. (Fig. 4)

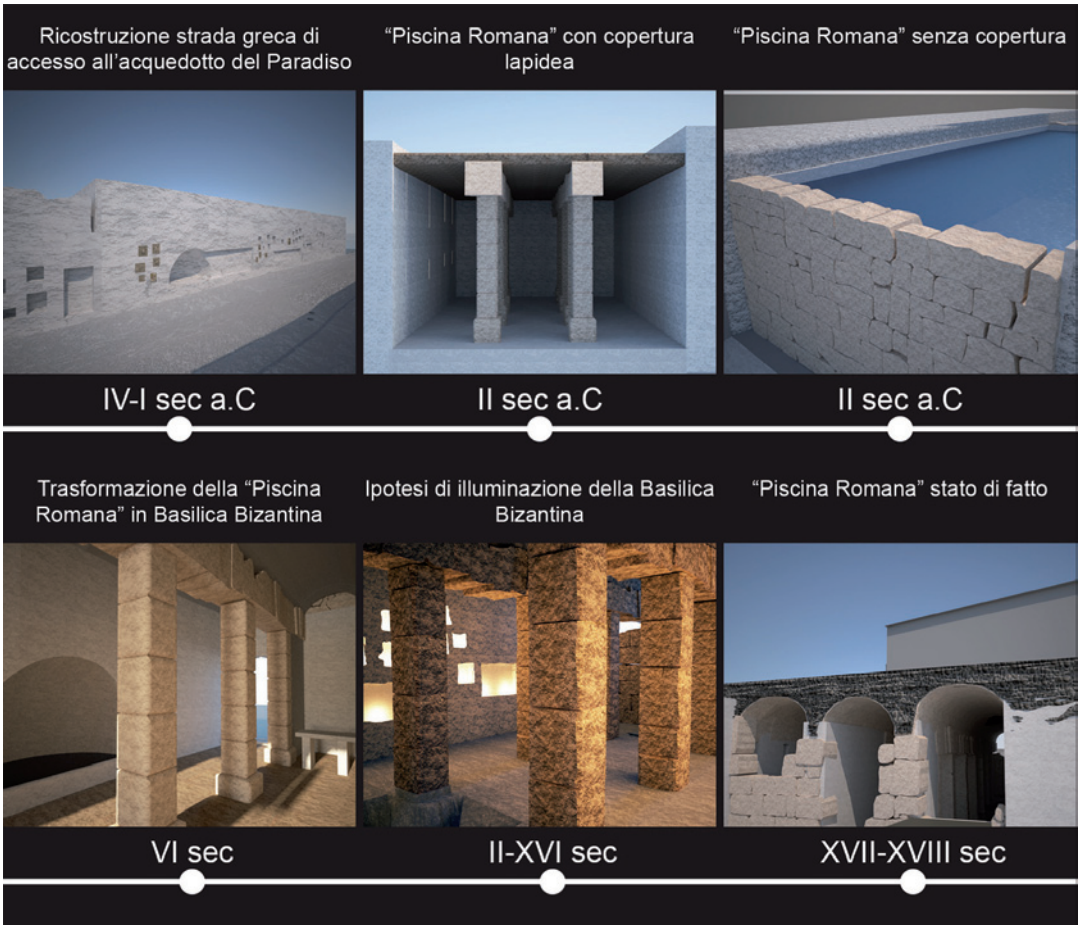

Fig.4. Roman Pool: virtual reconstruction and life cycle restitution. Images processed by the Laboratory of Representation, University of Catania.

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Archaeology/Landscape: a Mutual Influence in Both Directions

Giovanna A. Massari[a]*, Martina Tava[a]

[a] DICAM, Dept. of Civil Environmental and Mechanical Engineering, University of Trento, Trento, Italy – giovanna.massari@unitn.it, tava.martina@gmail.com
* Corresponding author

KEYWORDS: 3D modelling, architectural representation, laser scanner survey, lighting project, virtual reconstruction

We can read the landscape through the elements of the "perceived geometry" we have learned from the lesson of Kevin Lynch. The points are the nodes and references, the lines are the paths and margins, the surfaces are the neighborhoods of a complex territorial and human reality, that undergoes sometimes slow and sometimes sudden constant changes. Today, new computer techniques can communicate very effectively this reality and its space-time dynamics; indeed, virtual modeling is 4D and allows you to establish both geographical and historical relationships, between the dimensions of the small and the large scale and between the events of the past, the present and the future.
The digital representation techniques can also focus new aspects of the relationship between landscape and archaeology, including the indissoluble mutual link between the morphology of the place (as understood by Heidegger) and the anthropic forms arising from the unusual and sometimes exceptional architectural, typological or artistic solutions qualifying the place itself. Occasionally these solutions are completely unique; in fact, the multiplier effect determined by the mutual enhancement that architectural inventions produce in naturalistically extraordinary environmental situations is surprising.
Within these assumptions we have implemented the study of the San Gottardo castle in Mezzocorona (Trento, Italy), located on a wide horizontal rocky crack at about 150 meters above the village; a spectacular location that is difficult to reach but clearly visible from the valley of Adige river. The fortified citadel was a stately home from the Middle Ages to the sixteenth century, then it was occupied by hermits and abandoned in the early twentieth century. Nowadays San Gottardo is a great ruin whose morphological complexity depends on the uniqueness of the surviving architectural forms as much as on the incidental arrangement of the collapsed elements and the particular shape of the cave formed by the surrounding rocky surfaces.
This ancient architecture is in a critical state due to the site's hydro-geological hazard, the lack of access in safe conditions and the difficulties related to the property constraints. Nevertheless the castle still retains its role, constantly renewing over the centuries; it is the landscape reference point around which the lines-routes and the areas-settlements from where it is perceived gravitate. The use of analysis and spatial visualization digital procedures allows the

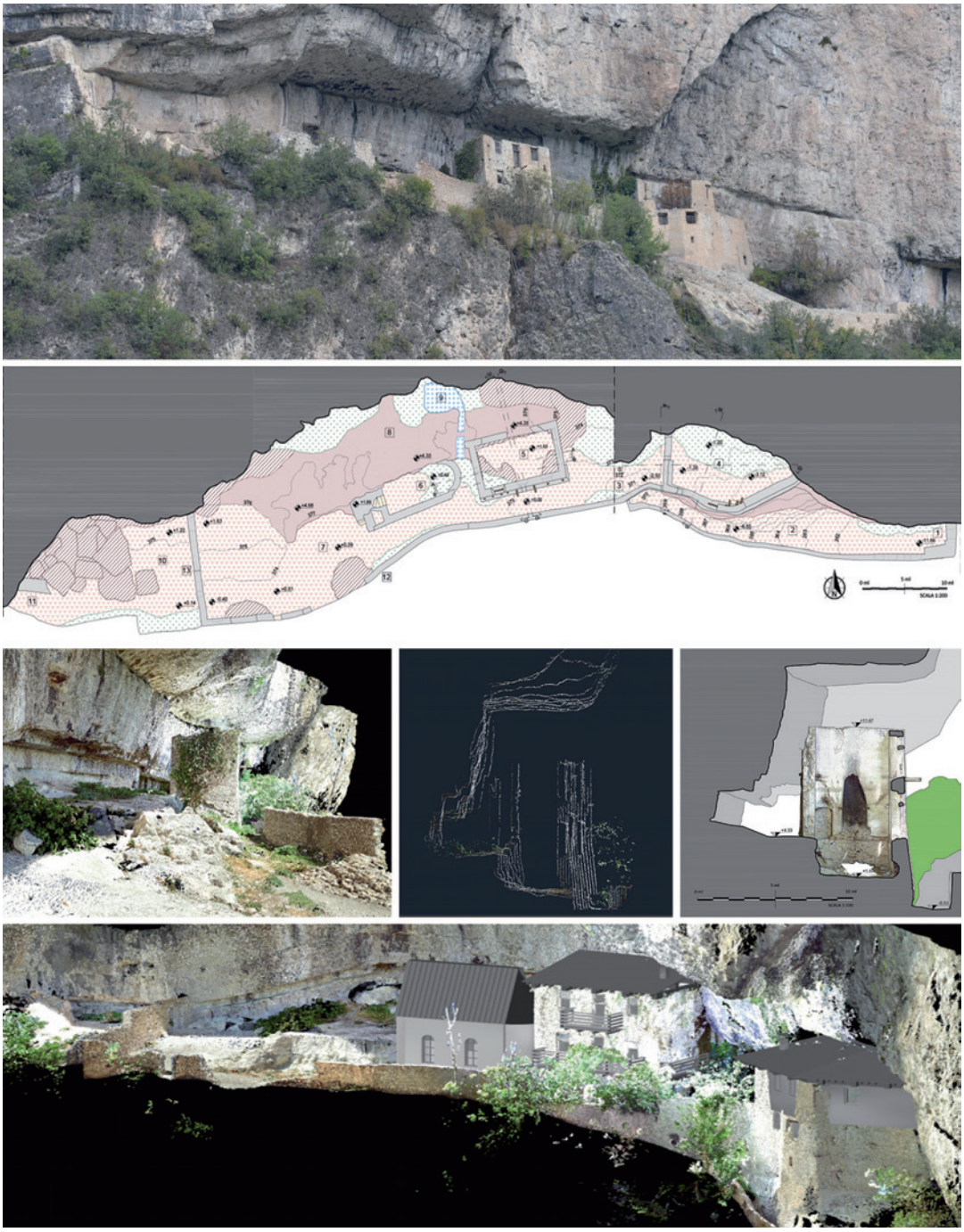

Fig. 1. The Castle of S. Gottardo, the architectural representations drawn from the laser scanner survey and the use of the points cloud for the original site's virtual reconstruction. In: Tava, M. (2015). Tecnologie digitali e salvaguardia dei beni architettonici: rilievo, modellazione e valorizzazione del castello di San Gottardo. Trento: master's degree Architecture and Building Engineering.

processing of images that are both the result of scientific knowledge and the tool for raising awareness, preservation and enhancement of the archaeological site and the whole environment. These images are addressed both for cultural tourism and for local identity.
The survey has faced the problem of the artificial and natural geometries' accurate description with the exclusive use of the laser scanning procedures; the instrumental equipment not only is compatible with the challenging logistical conditions *in situ*, but it offers a potentially unlimited ability to rapidly capture both spatial data and images suitable to perform qualitative assessments. Twenty-eight 3D scans were performed in a day's work in order to be processed and joined using the reference targets; these scans produce a first analytical model viewed by means of the points cloud from which the two-dimensional views, i.e. plant and elevation orthophotos, and hypothetical virtual tours through movies can be extracted.
The digital model was further manipulated to obtain the 2D and 3D vector-raster representations useful for the purposes of project and communication. The research critical issue lies precisely in having experienced the interoperability conditions between the representation tools and those of large data sets management, starting from laser scanner survey. The direct extraction from the points cloud of horizontal and vertical "thick sections" allows you to prepare the architectural drawings for 1:100 printing, needed to analyze materials, stratigraphy, decay and cracks and to study the preservation and consolidation interventions on the still standing parts, as well as the safety measures to counter the effects of hydrogeological instability. On the other hand, the laser scanner model processing through modeling, rendering and 3D animation software led to a double result: the first is the foreshadowing of the lighting project's final effect aimed to allow the monument's perceptual use at night; the second lies in the virtual reconstruction of a landscape artifact that is missing in its physical integrity but still visually perceived by means of the photorealistic restitution.

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Laser Scanner Survey Techniques For a 3D Documentation of The Archaeological Site Tas Silg in Malta

Giuseppe Mazzacuva

☞ DARTE, Department of Architecture and Territory, Mediterranea University of Reggio Calabria, Italy, giuseppe.mazzacuva@unirc.it

✔ KEYWORDS: *survey, 3D documentation, laser scanner, Malta, Tas Silg*

Introduction

The research carried out at the Department of "Conservation and Built Heritage" of the University of Malta included the process of analysis of Byzantine sites presented on the Maltese territory through a scrutinized study of bibliographic and iconographic sources regarding the most recent archaeological discoveries with the identification of the most significant sites on which to make three-dimensional measurements with a 3D laser scanner technology.
The bibliographic and iconographic research of historical sources and current studies at the library of the University of Malta allowed contextualizing the Byzantine phenomenon in Maltese area within a wider context that interested a southern Italy as well. The Byzantine evidences in Malta are not apparent but they are characterized by small archaeological finds as coins, amphorae and jewelry, found in different parts of the island.
Through these finds unearthed during the archaeological excavations over the last decades it became possible to identify sites of particular architectural interest, where the obvious signs of Byzantine domination in Malta remain.
The scientific approach to the Maltese archaeological heritage was not limited exclusively to identify the artifacts of the Byzantine origin but also to study the parameters and the methods of preservation, protection and enhancement of this heritage.
The analysis of the art state allowed establishing the research terms through a report on developments of the archaeological and scientific investigations over the last decade, and in

Fig. 1. Panoramic view of the archaeological site of Tas Silg

particular on the outcomes of the Italian archaeological mission in Malta, that since 1960 had undertaken a number of excavations of the important archaeological sites dating back to the Roman and Byzantine epochs presented in Malta.
The identification of the Byzantine site to be surveyed was suggested exactly due to the results of the several studies conducted by the Italian archaeological mission on excavations made at Tas Silg which represents one of the main sites with the artifacts of the Byzantine epoch in Malta. Therefore, the implementation phase was aimed at the realization of the survey operations with a laser scanner techniques for the acquisition of metric and formal data of individual artifacts presented within the archaeological area of Tas Silg (Fig. 1). The acquired data were processed subsequently through the scan running software SCENES 5.2, thus receiving in such a way a significant amount of information useful for the return of the archaeological area.

The archaeological site of Tas Silg

Tas Silg is a unique case of Maltese archeology because it represents a long uninterrupted settlement ranging from the prehistoric period to the modern age.
The site founded by the Phoenicians is situated on a hill overlooking the port of Marsaxlokk. It was the site of a fortified sanctuary (Fig. 2) that was occupied in its settings between the late Roman and the Byzantine period by a community that settled on the hill that even back then had to be protected by fortified walls on the north and south sides.

Fig. 2. Sequence of images of the archaeological remains of Tas Silg.

The presence of a bath coated in sheets and surrounded by a floor made with an opus *sectile* technique, probably used for a baptismal function, in the central area of the sanctuary, suggested to Cagiano de Azevedo the hypothesis of the possible existence of a Christian church built around the IV century (Bruno, B. & Cutajar, N., 2002). Using the old walls of the temple, the religious building and the resettlement of Tas Silg were linked by the researcher to the allocation of a monastic cenobitic community.

The court-peristyle area, occupied by a basilica with three naves separated by columns, also making use of an old late-Hellenistic courtyard flooring with an apse in correspondence to the central nave, dates back to the Byzantine period (Rossignani M.P., Airoldi F., Grassi E., 2011).
At the present state of the research, it's still difficult to decipher the characters of a new settlement that interested the site of the old sanctuary, even more, the presence of the church and the baptismal bath doesn't seem to be sufficient to indicate the existence of a religious community.
That which can't be called into question is the fact that from the VI up to the IX century the settlement took on a certain economic importance with a particular receptivity to trade and imports of pottery and ceramics.
Furthermore, the Tas Silg site continued to have a strategic and defensive role, probably during the Byzantine period as well, with the creation of walled structures built to reinforce the South facade towards the sea. These constructive evidences and materials of the Tas Silg suggested extending the research on the testimonies of the Byzantine period within the archipelago.
The contexts dated between VI and IX century were identified through a few classes of objects which represent the key chronological indicators of the period through the distribution of transport amphorae and oil lamps of African production (Bruno, B. & Cutajar, N., 2002).
The monastery was abandoned right after the Arabs occupied Malta in 870 A.D. The site was turned into a quarry and some parts of the original structure were removed and used in other constructions.
The Italian archaeological mission revealed the first excavations between 1963 and 1972, identifying the sanctuary and the different levels of the settlement of the Byzantine and medieval epochs that were found in some compartments of the northern part of the sanctuary. From 1996 to 2005 the University of Malta in collaboration with an italian group of researchers began another excavation project to clean other layers of sediments in the southeastern area.

The survey and the investigation of the archaeological site

The survey project of the Tas Silg site was divided into several operating phases to allow the acquisition of a large number of data finalized for a complete three-dimensional return of the area and its artifacts.
The literature search was focused on the recent analysis of the Tas Silg area with a particular reference to the archaeological reports written by the Italian archaeological mission since 1970, who annually reported the progress state of the excavations with historical, stratigraphic and archaeological notes (Fig. 3). This documentation was fundamental to know and interpret the overlap of the different historical phases presented on the site and especially with a reference to the Byzantine period.
Subsequently, the on-site inspection and the complete photographic campaign were carried out to acquire a preliminary documentation for the knowledge of the area from a morpho-

Fig. 3. Overlapping 3D laser scanner survey with multi-phase plan of Tas Silg drafted by Italian archaeological mission in Malta

logical point of view and with regard to the preservation state of the artifacts. Due to a high presence of weeds, a poor visibility of the planimetric tracks has occurred from the on-site inspection.

After a series of assessments concerning the area and its significance, it was considered important to proceed in the metric survey of the site through the use of laser scanner instrumentation. In order to proceed to the operating phase of the survey it occurred necessary to establish a cooperation agreement with the national agency "Heritage Malta", responsible for the protection and management of the site.

The existing plans drawn up by the Italian archaeological mission represented the graphic documentation necessary for the editing of the survey project, on which it was possible to determine and locate the stationing and points useful to define a total coverage of the area through the acquisition by laser scanner.

The survey operations with laser scanner were carried out in two days, following a stationing path which originated in the southern area of the site. The spherical targets were inserted within each scene and positioned in a uniform manner to allow their spatial location during the process of scans alignment.

The measurement phase was carried out with a laser Faro *Focus* 3D with a high accuracy of scans set to 1/4 of the maximum resolution, for an average duration of each one of 10 minutes, including the acquisition of data colour.
The 30 stationing with "environmental acquisitions" at 360 ° were made for a full coverage of the entire site that made possible to build the cloud of points, not just of the artifacts, but also of the local context. The small size of the instrument enabled to make a detection operation likewise in inaccessible parts of the site.
The small thickness of the walls upward (about 80 cm) and the lack of coverage allowed defining in effective manner in the geometric layout plan of the artifacts to understand and verify the dimensional parameters and the formal and structural characteristics of the buildings from the data acquired with the 3D survey. The phase of scans registration was performed subsequently with a help of the software Scene 5.2 with an automatic scans alignment procedure through the identification of spherical target and corner points in each scene. The obtained model contains a substantial amount of metric information from which it is possible to take detailed planimetric representations and site sections. The 3D survey (Fig. 4) of Tas Silg forms an important updated graphic documentation to continue the archaeological excavations with the verification of the former direct and instrumental surveys made by the Italian archaeological mission. Furthermore, it represents a base support for a future project of the site enhancement with the creation of paths for the place enjoyment by the visitors.

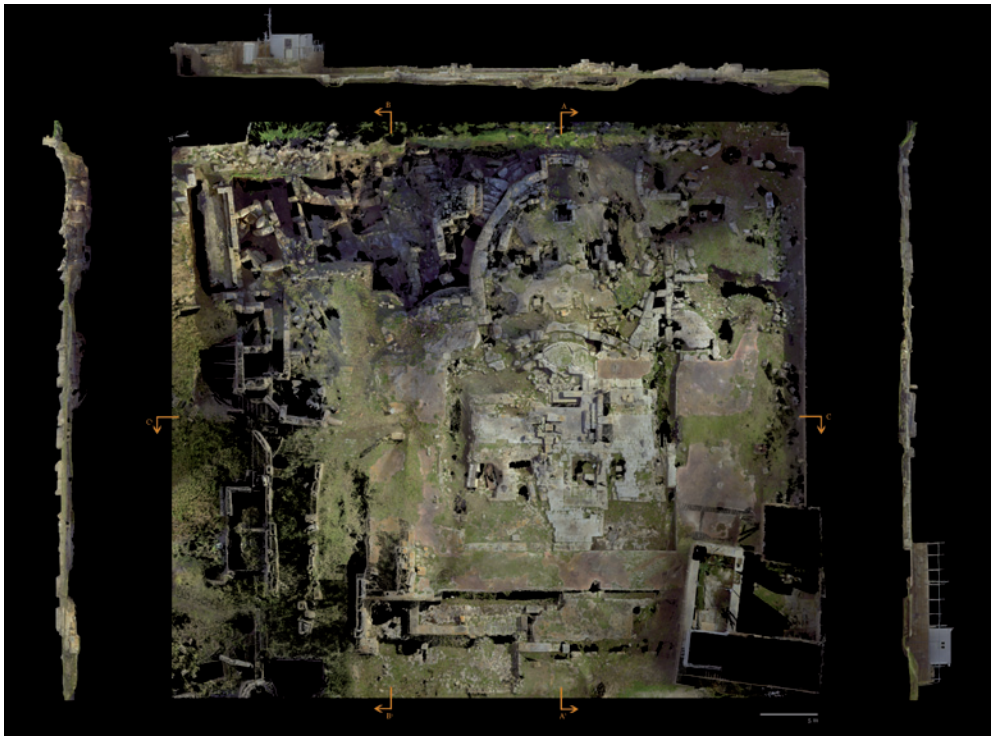

Fig. 4. 3D laser scanner survey of the Tas Silg sanctuary. Plan and sections.

Conclusions and results of the research

The 3D laser scanner survey of Byzantine architectural artifacts located in Tas Silg allowed interpreting heterogeneous data, to integrate complex models for achieving multi-scalar models from which to extract geometric and structural information. The obtained results confirm the importance of the integration between the different survey techniques and leave several research directions, concerning the field of documentation of archaeological assets, opened. The survey results were used to define the possible guide lines to continue the research experimenting on the drafting of computerized sheet for cataloging, starting from the 3D laser scanner survey data and return of the architectural models with CAD techniques, in order to define an innovative method of cataloging aimed to the restoration and enhancement of the Maltese Byzantine heritage.

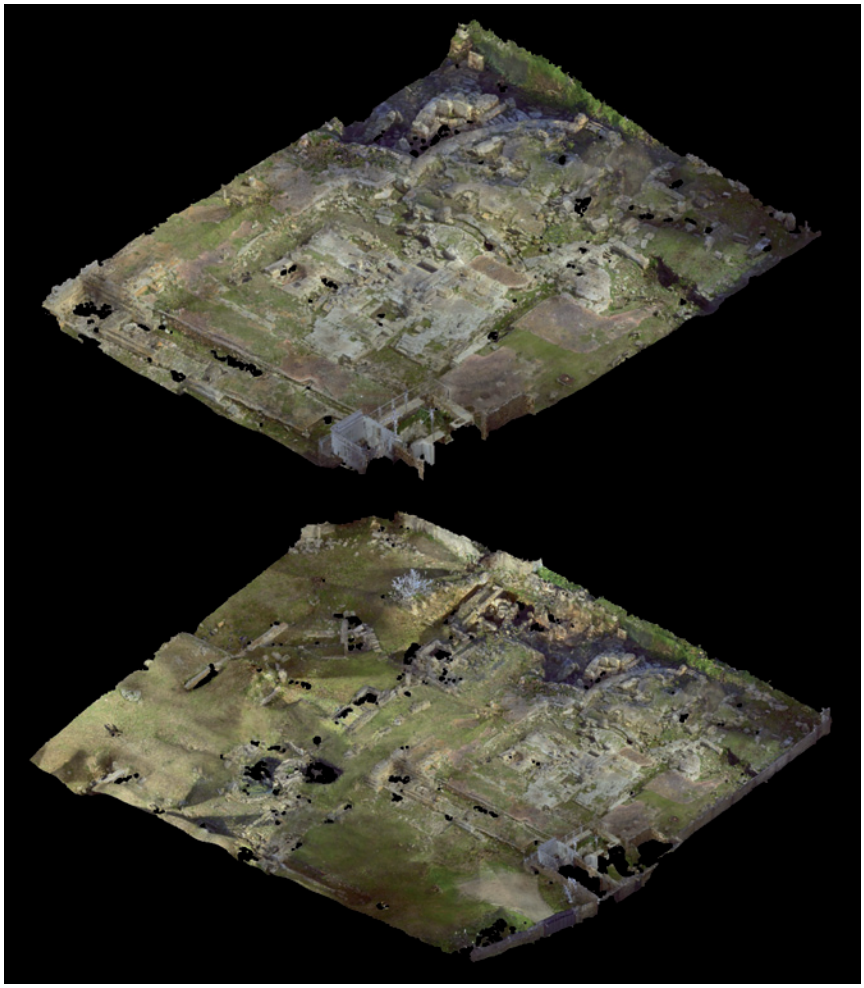

Fig. 5. 3D laser scanner survey of the Tas Sigl sanctuary.

Exactly this field seems to be particularly rich in ideas and needs to be scrutinized to define representation modes that can form a common and uniquely
interpretable language, even using the raw data derived from the point clouds without making further and more refined elaborations. It should be taken into consideration that the point cloud (Fig. 5) represents a vast digital archive for a researcher, a huge database to be investigated, as one chooses, in accordance with new or even further research directions.
The present scientific studies are the basis for a methodological process of interpretation and digital representation of the Maltese archaeological sites, defining also different interpretations on the level of communication and distribution through the use of the platforms and multimedia applications in which all the information regarding the architectural structures and the Byzantine archaeological finds is cataloged to make them accessible within the global network. Furthermore, it is possible to create an interactive direction for the usage of these sites by the visitor who accesses to this area for the first time: a path where often there is no complete information contained on the information tables of the monuments or explained by the touristic guides; but now, thanks to the new technologies they can be enriched with a multimedia content available on the mobile platforms that support augmented reality.

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Landscape, Archaeology and Digital Survey: The *Castellum Aquarum* of Poggio Murella, Manciano (Grosseto - Italy)

Giuseppe Nicastro

☞ DIDA, Dept. of Architecture, University of Florence, Florence, Italy
giuseppe.nicastro.gn@gmail.com

✔ KEYWORDS: digital survey, structure from motion, virtual heritage, castellum aquarum

ABSTRACT
The following paper introduces the digital survey (SFM integrated by topographical survey) of the ancient Roman cistern known as Castellum Aquarum of Poggio Murella in Manciano, (Grosseto-Italy) carried out for aims of knowledge and improvement.
Through the study of the historical sources and the archaeological context next to the cistern, the elements regarded as useful have been investigated to understand its presence in the landscape of Maremmano and its characteristics as an artifact.

1. The aims of the research

In the processes of improvement of a cultural heritage, the purpose is not just to preserve, but rather to transmit these "material evidence having a value of civilization", revealing its historical-aesthetics qualities, introducing them in an effective and comprehensible way and making its reading easy (Marino, 2002).
Starting from the assumption that an archaeological artifact is never an isolated or episodic element, but rather, a trace to be connected to other coeval signs, it seems clear, more than ever, the need to read the whole of these traces and to connect them one another in that *unicum* that contemporary scientific community defines as Cultural Landscape[1].
The digital technologies[2], in this sense, simplify and make a new and more dynamic typology of interventions possible: as a matter of fact the virtual reconstruction offers, on the one hand, the chance to operate readings and simulations of the physical reality of the artifact allowing us to shape the reconstructive hypotheses; on the other hand, the plurality of the forms of use of a digital model and its various outputs guarantee a flexibility of the virtual reconstruction that can be, at the same time documentation of the artifact and communication: static three-dimensional reconstructions and dynamics allow to expose complex information in a more complete visual way by building a channel of communication addressed to a wide and diversified number of users.

This paper is aimed to introduce the survey of the *Castellum Aquarum* of Poggio Murella located in the town of Manciano (Grosseto), carried out to document the foundations and every formal and constructive characteristic for aims of knowledge and improvement. The commitment to get similar results to those produced with complex systems, using entry level

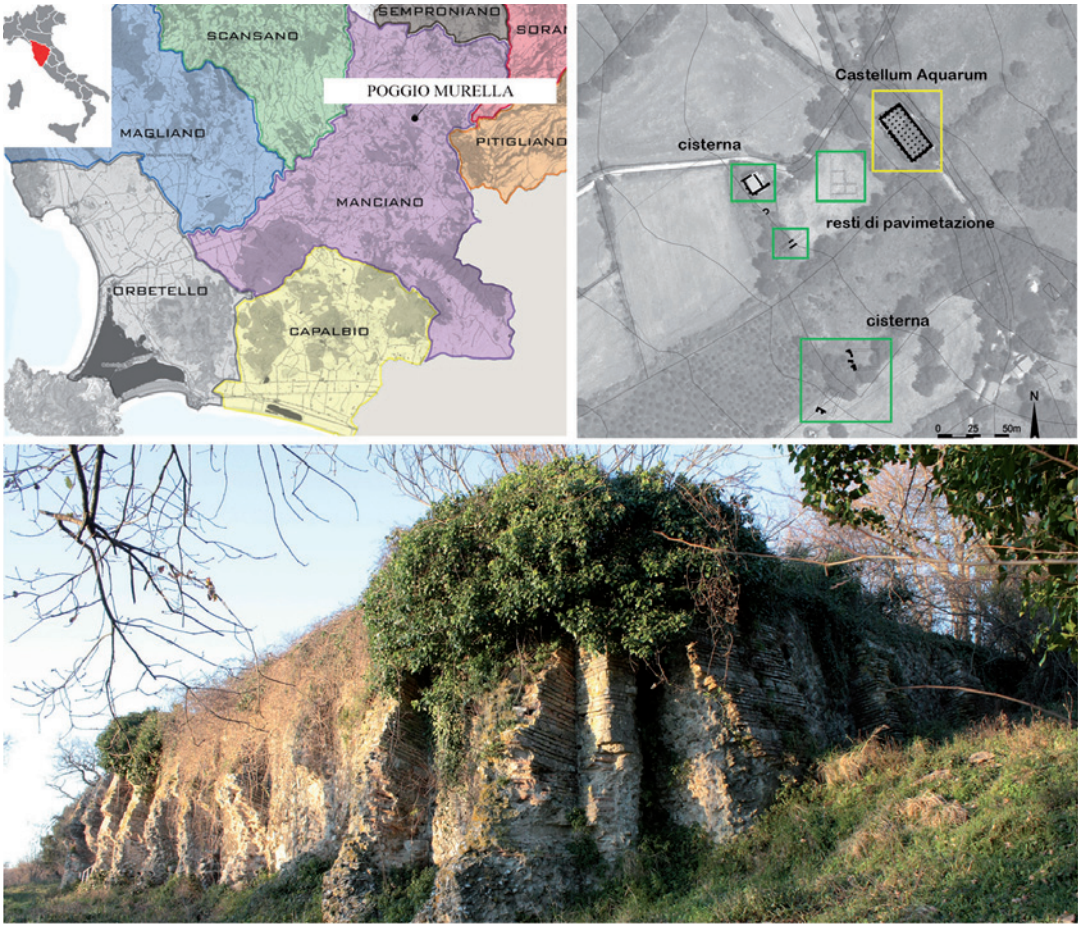

Fig. 1. Poggio Murella: archaeological area of *Castellum Aquarum*

technologies, has directed the methodological choice toward the three-dimensional photo-modelling integrated by topographical survey.
In the attempt to widen as much as possible the story of the artifact, a part of this work has finally been devoted to the study and to the historical reconstruction of the events useful to understand the presence of this heritage in the landscape of the Maremma.

2. The Roman colonization of the Southern Etruria: the Castellum Aquarum *of Poggio Murella in the landscape of Maremma*

With the most recent topographical discoveries about the exact location of the city of Heba and the other coeval realities (the agro cosano, Roselle, Vulci, etc.), the cistern of Poggio Murella contributes to widen the story of the events that have marked the colonization of the southern Etruria in that process of "Romanization" that from the IV century B.C. on will

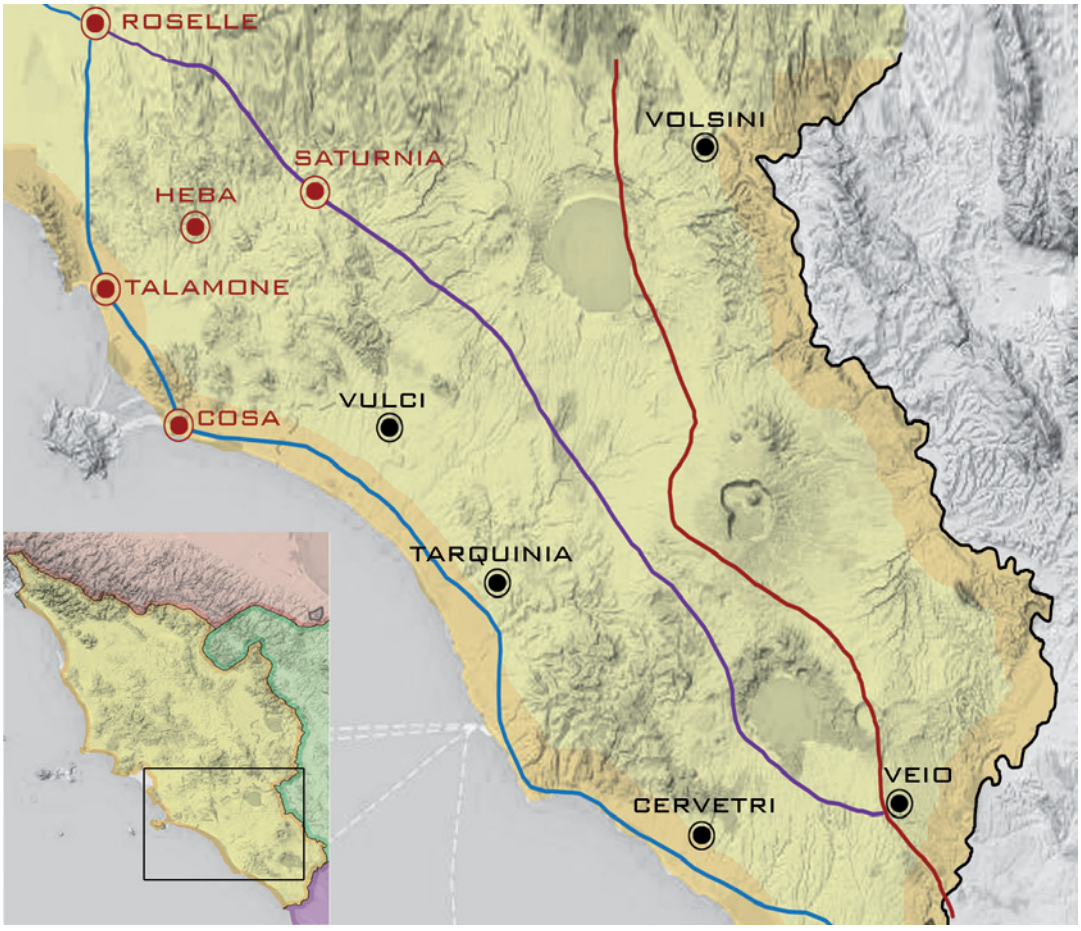

Fig. 2. Roman colonization of the south Etruria

extend far beyond the national borders. At the end of the VII century B.C. the Etruscan expansion toward the south of Italy had come up to the territories of ancient Rome whose extension, at that time, was still notably small: it was in the age of Tarquinio Prisco, Servio Tullio and Tarquinio il Superbo, time in which the city expanded toward northwest (Livio). At the deadline of the Treaty that had ended the preceding war, Tarquinio il Superbo got to restore the peace with the Etruscans (524 B.C.), but in the end the Etruscan kings were however expelled in the context of a wider deprivation of power in the area of the ancient Latium Vetus (Floro). In 396 B.C., after a war lasted almost one decade, Rome conquers Veio extending its influence over part of Southern Etruria. The expansion of Rome between the V and the II century B.C. appears unrestrainable and almost miraculous due to the number of open fronts and to the quantity of mobilized troops. In the dawning Roman imperialism, the conquest of Vulci (280 B.C.) is set as a central episode of the last phase (377-264 B.C.) of the long and fierce war between Rome and the Etruscans. The Roman victory in Sentio (295 B.C.) and the heavy conditions imposed on the Etruscan cities are the sign of the domain over the italic westerners

now irreversibly annexed to Rome (Brizzi, 1997). All those that had been the main Etruscan centres, Chiusi, Rocelle, Vulci, Veio, etc., will sooner or later, fall in the Roman expansionistic aims. The Romans identified in 273 B.C., almost in the middle between the mouths of the Fiora and the Albegna rivers, in Cosa, nearby the current Ansedonia, a pole of development and a site of strategic control (Detti, 1998).
Toward 190 B.C. the track of the Aurelia road was defined, Cosa was embellished with monuments and also inserted in a new project involving Magliano and Saturnia; the latter one was designated as colony of repopulation in 183 B.C. and was also connected to Cosa through a road axis working also as settling axis.

The population characterized by rural settlements, meant as productive centres, was slowly being replaced by the "farm villa", a large landowner farm type that used independent manpower as well as foreign slaves for the pasture of the livestock, as reported by Plutarco.
Although through the historical sources the importance of Saturnia seems relatively recent, in the time immediately antecedent the Roman occupation, we mustn't think that in the most ancient period was a negligible centre: the archaeological discoveries done in the past in the most ancient necropolises would actually confirm the vitality of Saturnia since the time of the Villanovian civilization (Minto, 1925).
There are numerous traces of Roman constructions discovered inside the same country where remains of walls can be seen to appear on the surface near the dean church and the Roman door and rests of polychrome enamelled floors were found under the houses facing Vittorio Veneto square. In the most elevated point of the city, where in the XV century the fortress Ciacci raised, appear the traces of a majestic construction that embraces the same fortress: the masonry in concrete and the above layer of enamel have led to believe that the construction may refer to a great *castellum aquae* (Rendini,1999).

The foundation of the colony must have brought a radical transformation of the pre-existing territorial order: the arrival of the new farmers had as a result an increase of the urban population as well as a growth of diffused settlements on the territory nearby the assigned allotments. We have therefore strong indications in Saturnia of a very rational system of division of the centurial fields articulated in well separate sectors: fields assigned to farmers, fields assigned to great owners and fields reserved to their native occupants (Camilli, 2007).
From this perspective of territories subdivision, the villas and their productive system, that foresaw the assiduous and constant use of slavery manpower, appear as essential knots in the process of Romanization of the areas concerned with the colonization (Carandini, 1989). For these reasons there is no motive to doubt that the numerous findings that over the years have also been made in the area of Poggio Murella (Pasqui 1882, Minto 1925) can be attributed to one of those facilities for agricultural productivity. Not only the *Castellum Aquarum*, together with other not far two more modest reservoirs, but also column drums, portions of flooring and building plinths (Torelli, Masseria, 1992) would confirm Roman presences in this area not too far from the urban centre.

3. Methodology of the research

The suburb of Poggio Murella is located a few kilometres from Saturnia: a small residential area made up with housings risen in more or less recent times. In the nearby country areas close to the residential zone, a wide rectangular terracing is almost entirely occupied by an artifact with typically Roman constructive traits: the ruin is known as *Castellum Aquarum* of Poggio Murella and represents one of the most important archaeological landmarks of the area. The cistern appears as a building enclosure of 35 ml X11 ml, sticking out from the ground for a height of 5 ml and what can be seen today is the above ground part of a construction mostly buried below the walking path.The main façade presents ten panels in *opus reticulatum* articulated with as many buttresses in *opus vittatum* (rows of thin bricks alternated to semi squared stone ashlars). Always on the same façade, three openings of very reduced height could probably represent the points of release and hookup of the pipelines of the Castellum. One of these three openings is also nowadays the unique point of access inside the building enclosure, being the other two obstructed by soil and debris. Entering we find ourselves in the third of ten barrel vaults that run according to the smaller length of the inside space: each of the vaults is supported on the long sides by three central pillars and two external buttresses, also them in *opus vittatum*: these supports are connected by four valuable bricked arches. Only six out of the ten original vaults are still entire: the first five are currently situated in the entry place while the following four aisles have not resisted to the burden of time and have collapsed.

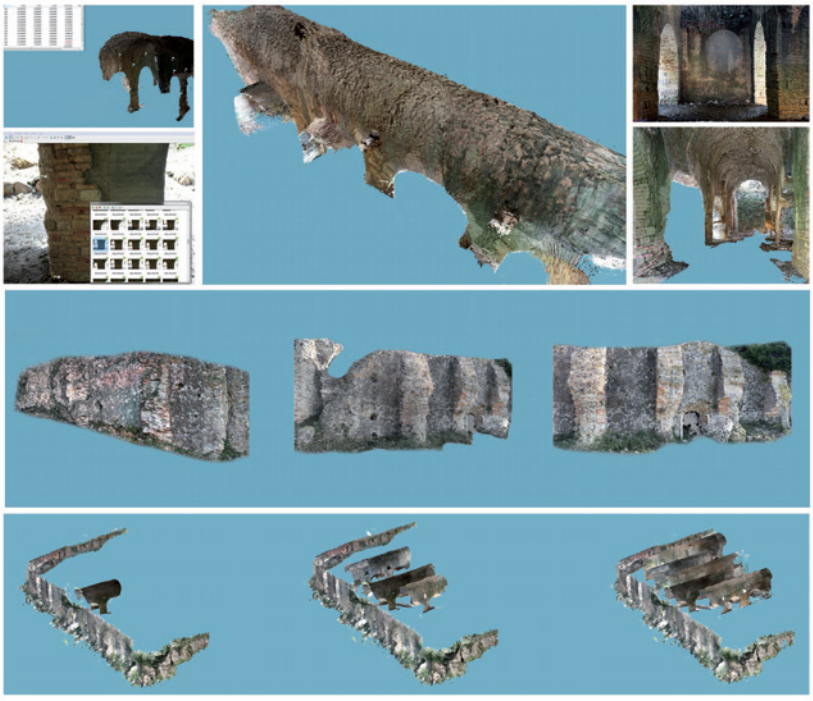

Fig. 3. *Castellum Aquarum*, digital survey: Point Cloud

The survey campaign[3] has been carried out by integrating two different methodologies of data acquisition: Structure from Motion and topographical recording of the cloud of points.
For the topographical survey a link of nine stations has been realized while for the photo-modelling the number of necessary photographic takings involved around 10.000 images: during the elaboration stage this number underwent a reduction due to the elimination of the unsuitable photographic takings as out fire, with too marked chromatic variations, or for problems due to over/under exposure. At the end of the survey campaign every photographic set was "lined up" in order to evaluate its geometric correspondence with the reality and then to produce, in a second time, a dense point cloud. Once finished all the alignments it was necessary to integrate the two systems of acquisition namely to use the data of the topographical survey "to record" and therefore make the fragmentary and independent ones produced by the photo-modelling univocal. Importing all the single portions, referenced and optimized, into a specific environment software was therefore composed an geo-referenced point cloud from which it was possible to extract all the data useful to the elaboration of the 2d graphs and the three-dimensional models.
A part of the survey campaign was devoted to photo images acquisition useful to the creation of spherical photos. In the case of Poggio Murella thirty spheres have been realised, each of

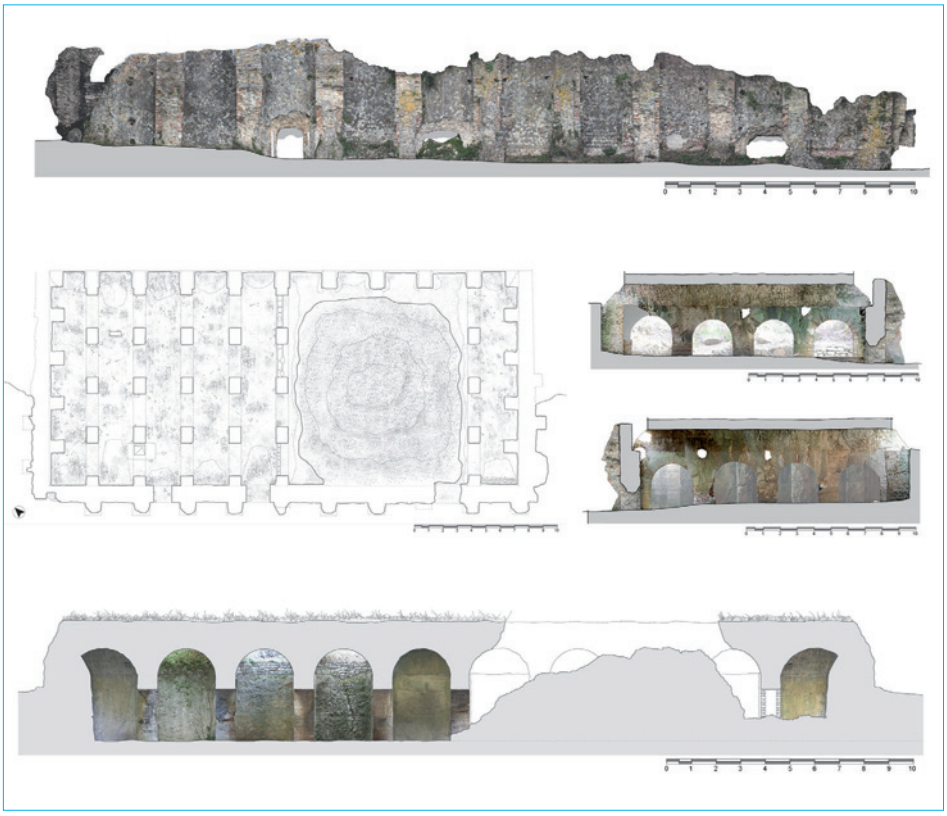

Fig. 4. *Castellum Aquarum*, digital survey: 2d graphic representations

which composed approximately by eighty photos, distributed between the inside and the outside of the artifact. As widely known by now every sphere becomes a stage and a station point of a real guided tour: software applications specific for the purpose allow in fact to connect the various overviews through interactive links, by integrating them with textual information and dynamic animations, creating so a Virtual Tour that allows to visit the site also if not being physically present.

4. Conclusions

According to the principles and the declarations reported in the 18th General Assembly of Icomos[4], the cultural landscapes must be interpreted not only as places of preservation but also as successful cases in applying innovative strategies and tools. The access to the cultural heritage, to be effective, requires an approach to planning and interpretation diversified on several levels: it needs in fact to guarantee the physical accessibility but it is also necessary to

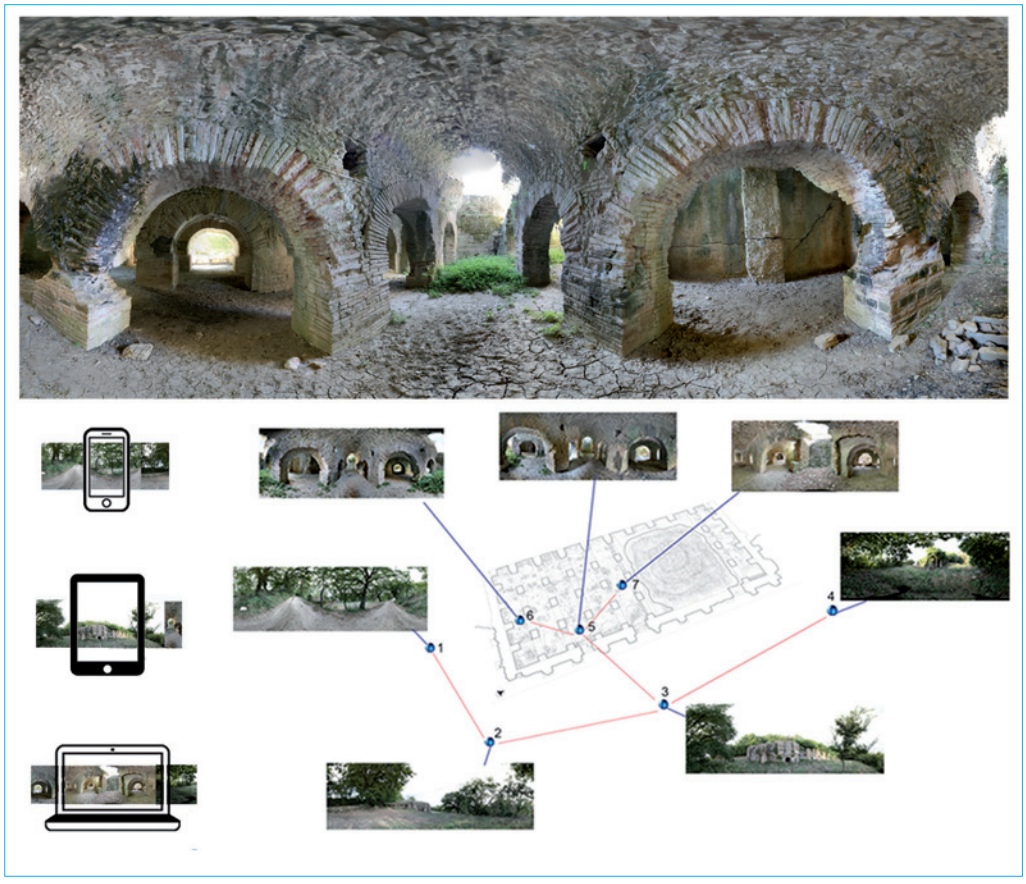

Fig. 5. Digital Survey: 360° photo spere and Virtual Tour's work flow

assure its diffusion through strategies and procedures for the interpretation of the heritage that give priority to the use of user-friendly and also low-cost technologies.
A project meant to add value to the *Castellum Aquarum* of Poggio Murella should certainly adopt the above mentioned guidelines and apply all these methodological procedures. The cistern has been in a state of almost total disrepair for years whose overcoming has first of all to start from the necessary awareness of its value; the study introduced in here wants therefore to represent a partial contribution for the documentation and the up-to-date representation of the artifact providing at least a deepened informative support to start a possible future intervention of improvement.

Picture's source
All the images on the previous pages have been created by the author of the paper.

Notes

[1] "Cultural landscapes have been defined by the World Heritage Committee as geographical areas or distinct properties that represent the combined work of nature and man The World Heritage Committee has identified and adopted three categories of cultural landscapes ranging from those landscapes designed and created intentionally by ma, through a organically evolved landscape". UNESCO, 2005, Operational Guidelines for the Implementation of the World Heritage Convention, <it.wikipedia.org/wiki/Paesaggio_culturale>.

[2] A comprehensive and updated report on the state and the technologies applied to the survey and representation is available in Bertocci S., Arrighetti A., a cura di, 2015, Scires-It, Vol. 5 n°2, an overview on the digital survey and advanced visualization of data applied to archaeology.

[3] Cistern Has Been detected as part of the Master's Degree thesis "Digital Survey and virtual heritage. *Castellum Aquarum*, Poggio Murelle in Manciano (Gr). Grad Student: Giuseppe Nicastro. Teacher: Prof.ssa Paola Puma. Co-rapporteurs: dott. Andrea Camilli, dott.ssa Mariangela Turchetti. University of Florence- Departement of Architecture

[4] Florence Declaration. Heritage and Landscape as Human Values". ICOMOS, 18th General Assembly, Italy, Florence 2014.

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Arca Project: a Reusable Approach to Archiving, Research and Communication in Archaeology

Irene Carpanese*

☞ * PhD. University of Padua, Dep. Cultural Heritage

✔ KEYWORD: Database, Web Sites, Questionnaire

ABSTRACT

The main idea of ARCA Project is that through a CMS-like architecture it would be possible to provide a software product, intuitive for most users, aimed to ease the publication of media related to archaeological sites. The project has two main objectives: to make the archaeologist autonomous in the management of online applications; to protect collected data; to create an automated procedure in order to guarantee compliance, accelerate the comparison between similar projects.

Introduction

The World Wide Web nowadays is recognized as a primary key-infrastructure for every country in the world: around 40% of the world population, to the 1st of July 2016, has an internet connection, while in 1995, this variable couldn't reach the 1%. In 2014, nearly 75% (2.1 billion) of all internet users in the world (2.8 billion) lived in the top 20 countries. Our country is one of these. High speed backbones are still broadening across continents, and mobile devices with data capabilities are spreading even amongst the poorest country inhabitants: emerging economies are going to push even more effort for this growth in the near future. As a consequence there is an increasing demand of services that could vehiculate knowledge across the internet, and ease the spreading of humanities-related content, in Italy and across the world. The WWW was born as a medium for the remote sharing of scientific knowledge; subsequently has evolved in something different, but still represent the best support and integration for both traditional and innovative research processes, and could give visibility to every discipline far beyond academic circles.

Objectives

The idea behind ARCA research project, was born from a perceived need during a previous work, which comprised the development of web site for an archaeological excavation. There was a gap in this specific scope, for the online media publication process that needed to be filled. This objective will be accomplished through the study of a specific conceptual model, for excavation data representation, interaction, and exposition, in order to maximize the informational throughput for expert and casual users. It is now widely demonstrated, and also accepted as common sense, that research data should be shared within the scientific com-

munity, to amplify their impact and turn the debate on (obviously without interfering with the normal academic publication system). Furthermore also common people should be aware of the ongoing research progress, possibly exposed in each of its atomic parts, not just for ethical reasons, but also as a function of a cultural and economic growth of a territory.

Project

Fig. I Arca Project's Logo

The name of this project, A.R.C.A. is the acronym for "Archiving, Research and Communication in Archeology", but it is also the italian word for "ark", the archetype of the vessel, capable to store and preserve a payload. The meaning is quite plain to see: a web site to collect different kind of data, like an ARCA for archaeological contents (Fig. I). The original concept was based on two similar alternatives: the creation "from scratch" of a small very specialized CMS, or a module/tool integration to customize an existing one. The main idea is that through a CMS-like architecture it would be possible to provide a software product, intuitive and intelligible for most users, aimed to ease the publication process of media related to archaeological sites and share this very specific knowledge at different level with experts or with a wider audience. Actually, an initial survey on "the state of the art", revealed the existence of other solutions that could produce the same basic result, but with some secondary differences in the final outcome, like customization capabilities or ease of use. Those development options will be investigated deeper in the following months. The project has two main objectives: satisfy archaeological-experts/web-users expectations as viewers and on the other side make the archaeologist autonomous as publisher and manager of web domain-specific contents. As a side effect the publisher will be encouraged to protect his own data through the digitalization process. Datasets will be converted/prepared/refined and made as homogeneous as possible, through an automated standardization procedure; in this way the compliancy is guaranteed, and the comparison with other similar projects will be more immediate, easier and faster. The final outcome will be tested on two case studies: Nora, an archaeological excavation, already published (Bonetto, Falezza, Ghiotto, 2009), and Ca' Tron, a multidisciplinary project, already closed and not yet published (Busana, Ghedini 2004; Ghedini, Bondesan, Busana 2002). A similar idea, declined for museums and expositions, has been developed and founded in collaboration with the Italian Ministry of Cultural Heritage (Project "Museo & Web"), and is already available to final users; unfortunately a deep analysis of this software product revealed many application limits for the inclusion of data from archaeological research, due to the different needs strictly related to this one (Natale, Saccoccio, 2009).

Progress

The passages in which the development process could be subdivided (*Divide et Impera*) are:

• Study of the "state of the art" and legislation
• Preliminary evaluations and use-case analysis
• Study of the CMS "Museo & Web"
• Identification of software solutions
• Development of software tools
• Case studies and testing phase
• Evaluation of the final outcome through users experiences

ARCA Project is a Ph.D. research project which started in November 2015, and it is just at the beginning, nevertheless some basic parts have already been made. The first step was the analysis of current legislation regulating online publications and cultural heritage data protected from copyright (more specifically data from archeological research). At the same time an interview has been prepared, in collaboration with other experts from different disciplines (psychology, user interface design…), in order to promote a balanced, objective and scientifically valid approach, and get valuable results, that could be reused in a specialistic sector study.

Survey

The idea to structure the work-flow of the whole project using an incremental step by step procedure, which comes directly from the well known and widely adopted "interactive and incremental development model", (https://en.wikipedia.org/wiki/Iterative_and_incremental_development), toghether with some user-experience and software development best practices, had the direct consequence to put in evidence the somministration of a preliminary evaluation interview to a small but significative target user group, as the optimal choice for one of the first milestones. In the past those key concepts have been used successfully in many software projects; nowadays are rediscovered and applied again, also to many different domains, such as humanities and cultural heritage. One of the most relevant project in this perspective is "Mappa project": its interdisciplinary research team followed those best practices "to study predictive calculation instruments applied to the archaeological potential of an urban area and to create a product which will contribute to the protection, research and governance of the city and of its underground archaeological heritage". Their questionnaire was submitted to a large group of people and they collected over 600 answers about open data. Of course, the whole impact of the Arca project preliminary interview, whose name is "Let's do it together" is lower, both for number of questions and for sample space size, but it has been very useful to gather usage information from web users about actual cultural aimed web application. From the pure practical point of view, it has been built simply using Google forms web application; one hundred people has been invited to take part at this preliminary evaluation process.

The questionnaire was structured in 7 sections, for a total amount of 50 questions and practical experiences. In a preliminary phase the interview has been sent to users coming exclusively from the University

Fig. 2 Respondents divided by age, gender, occupation and origin

of Padua, and more specifically from the Cultural Heritage Department. After some "fine tuning", has been opened to a wider audience from other universities in other countries and also specialists from other disciplines. The idea behind this first step was mostly to gather as much

anonymous evidences as possible about functional feedback and user needs, trying to map also perception changes depending on origin, age, occupation and education. Collected data are yet under analysis, but there are some preliminary observation that could be presented: 75% of the subjects declared that the digitization and online publication of data is "*very important*" (41%), or even "*essential*" (35%) for the survival of the archaeological discipline; in disagreement only 5% (Fig. 3).

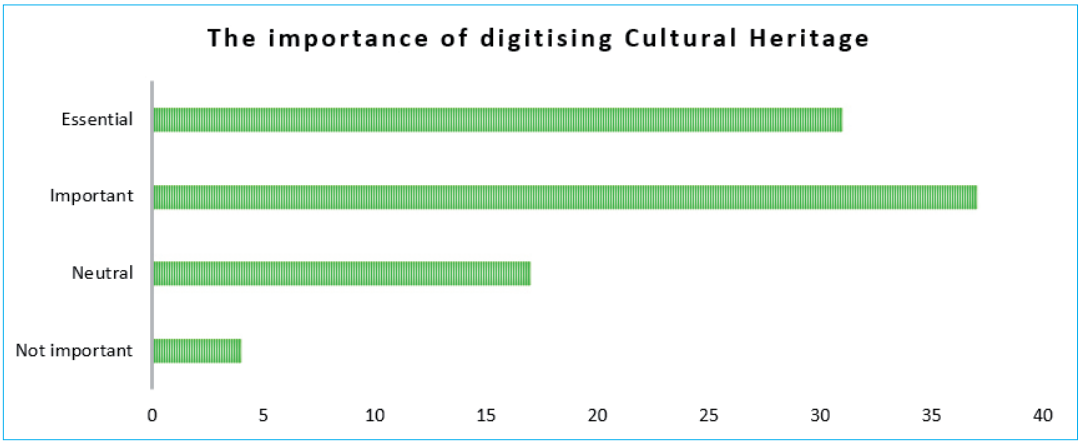

Fig. 3. The importance of digitizing Cultural Heritage

92% of the people says that an archaeological excavation should publish online data through specific websites. In fact more than half of the interviewed (59%) uses internet to work and visit "*at least once a day*" University websites, institution portals, or database of archaeological excavations (Fig. 4a). Most users visit sites for work or study, only 28% for curiosity (Fig. 4b).

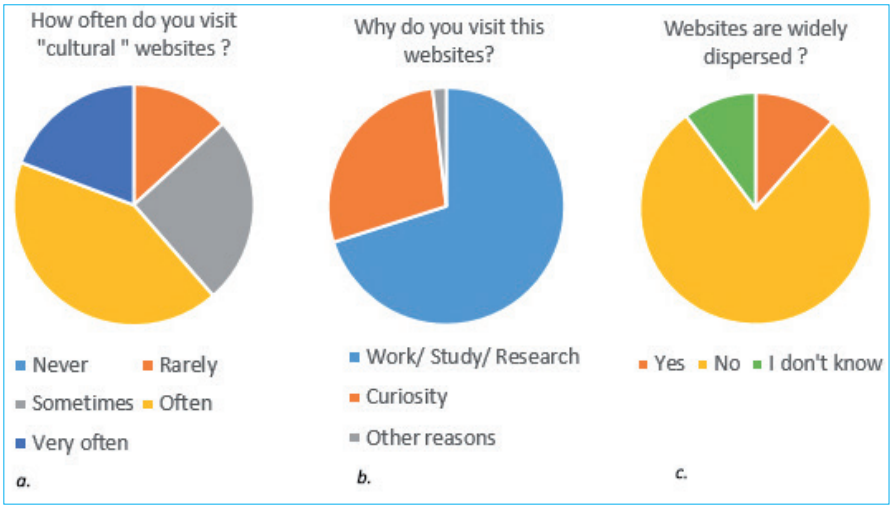

Fig. 4

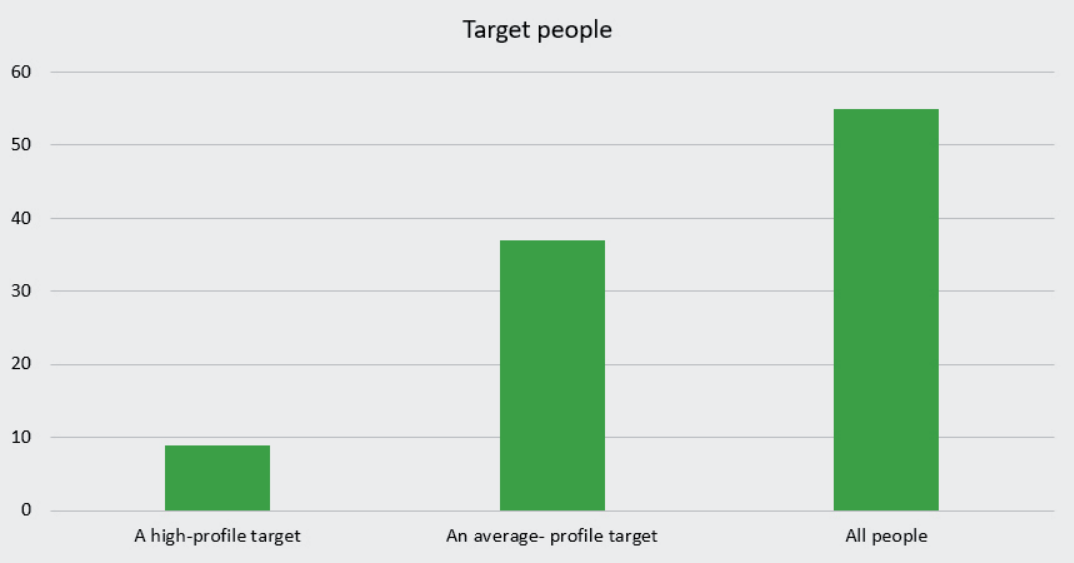

Fig. 5. Target people

In the same way they believe that cultural web sites, and specifically archaeological web sites, (for 78% of interviewed), are *"not enough diffused"* (Fig. 4c).
Still, the targets of the interview, are divided on the question: which kind of users should be targeted mainly from archaeological website developers? 60% says "All the users", and just 37% believes that those contents should be addressed only to a "medium-high" audience (Fig. 5).

Conclusions

There is only one conclusion to be drawn at this initial stage of project: the sharing of data in Cultural Heritage disciplines is absolutely essential. As cheap information medium however, the internet has nowadays a slightly wider impact than some prior forms of communication technologies, and must handled with care and with the appropriate know-how. The bibliographic research about laws and regulations has shown national and international/European efforts to simplify bureaucracy that control open knowledge access and diffusion. In the next few years we expect that the data publication will be much more simple, especially for archaeological data.

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Art and Technique of Roman Bridges. The Augustus Bridge in Narni.

Leonardo Paris[a], Carlo Inglese[a], Wissam Wahbeh[b], Pamela Maiezza[c], Maria Laura Rossi[a]

[a] Sapienza University of Rome; Department of History, Representation and Restoration of Architecture; leonardo.paris@uniroma1.it; carlo.inglese@uniroma1.it; marialaura.rossi@uniroma1.it;
[b] FHNW University of Applied Sciences and Arts Northwestern Switzerland; wissam.wahbeh@fhnw.ch
[c] University of L'Aquila; Department of Civil, Construction-Architectural and Environmental Engineering; pamela.maiezza@graduate.univaq.it

KEYWORDS: Augustus bridge, digital survey, 3d modelling, Roman building technique, cultural heritage.

ABSTRACT

Along the Via Flaminia, one of the main crossing roads of Umbria, near the town of Narni, Augustus built a bridge to cross the Nera Valley, a huge engineering work, one of the greatest masonry works built by the Romans, with four arches of which one still intact. The archaeological site, after more than 2000 years, keeps unchanged the relationship with the city of Narni, the Nera valley and the entire valley of Terni.
From the 1800 until the Second World War this area has undergone significant modifications.
The Augustus bridge in Narni is being studied for centuries, from Renaissance onwards. In recent times, several engineers surveyed the bridge, with the primary objective of consolidating the existing structures in order to prevent further instabilities and collapses. Some of them have also hypothesized the original configuration and the changes occurred over time. In 2015, our research group has made a new survey with laser scan digital technologies integrated with photogrammetry, broadening the area of the previous surveys. The survey elaborations have allowed to formulate new hypotheses on the conformation of the four arches of the bridge and on the location of the ancient Via Flaminia. Another aspect of the contribution relates to the identification of the potential of 3D modeling in the new digital modes of communication of the cultural heritages. It can thus promote new forms of dissemination and knowledge to a diverse audience, showing how, in this case, the building technique can rise to real art, respecting of the landscape.

Introduction

The remains of an ancient bridge are often strategic testimony of an environment that, although in many cases deeply changed, maintains stable some of its constituent elements.
The archaeological importance is accentuated by specificities of different types. There are constructive considerations that refer primarily to the evolution of construction technique for sizeable infrastructures; evaluations of the orographic aspects (in many cases deeply changed) that have influenced the location, the realization and phases of use; finally, there are the aesthetic aspects that make these structures real works of art.
In these cases, we find the extreme synthesis of the Vitruvian triad, the "firmitas", the "utilitas" and the "venustas". In this, the Romans were real precursors (Galiazzo, 1995; Durán Fuentes M., 2005).
That is why the study of the Augustus bridge, based on the use of the most modern methodologies of integrated digital survey (Paris, 2014), represents an important opportunity for the

analysis, the knowledge and the development of the archaeological area and of its wonderful environmental context.

The Augustus Bridge in Narni

The Via Flaminia is still today one of the main crossing roads of Umbria. Many stretches correspond to those of the ancient road built by the Romans in the time of Augustus.
Near the town of Narni, where, even before the Romans, there was the ancient settlement of "Narnia", Augustus in 27 BC built a bridge to cross the valley of the Nera. A huge engineering work, one of the greatest masonry works built by the Romans, with four arches of which one still intact (Fig. 1).

Fig. 1. The remains of the Augustus Bridge (by Paris); photo and ancient representation (Tattoli, 2000).

The charm of this archaeological site is due to its high landscape value that, after more than 2000 years, keeps unchanged the relationship with the city of Narni, the Nera valley and the entire valley of Terni. The discovery, in recent times, of a cave with medieval frescoes, whose position is important to locate the layout for the ancient Via Flaminia, and the subsequent construction of the Sanctuary of the Madonna del Ponte, have greatly increased the historical and landscape value of this area (Fig. 2).
A consistent iconographic repertoire (Tattoli, 2000) of images dating from the second half of 1600s up to the 1800s, documents the romantic and sometimes bucolic atmosphere of the site. In these images the bridge is not a work of engineering but it's itself landscape.
There are also artists who have given prominence to the engineering aspect of the work with very realistic representations, which have a documentary value. These images are particularly

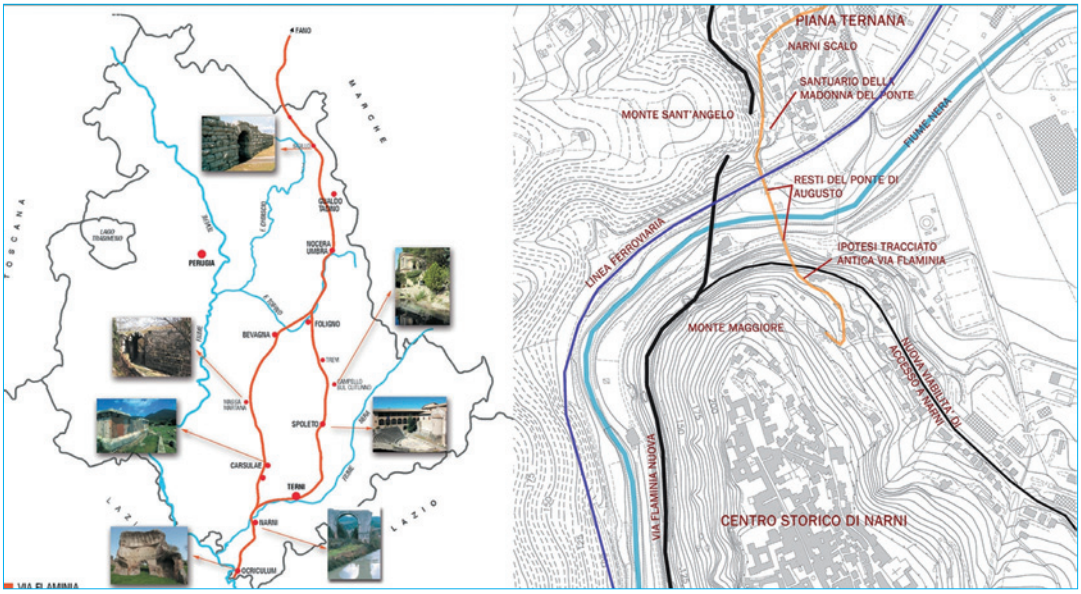

Fig. 2. Territorial and urban framework (by Paris).

useful in the reconstruction of recent historical events that have also led to significant modifications, such as the opening of a new arch to allow the passage of the railway line, in 1860, and the collapse of one of the pillars occurred in 1885.

From the end of 1800s until the Second World War, this area has undergone major changes: the realization of hydroelectric power plant, an important railway line and the new roads alternative to the Via Flaminia, from and to Narni.

The Augustus Bridge in Narni is being studied for centuries, from Renaissance onwards. In recent times, several engineers surveyed the bridge, with the primary objective of consolidating the existing structures in order to prevent further instabilities and collapses.

Some of them have also hypothesized the original configuration and the changes occurred over time. One of the most recent studies, based on the survey with innovative topographic and photogrammetric instruments, was curated by Alberto Cecchi in 2003, that was an important reference for us (Cecchi, 2003).

One of the main objectives was to check the position of the remains of the bridge in relation to a wider environmental context than what investigated in previous studies. The bridge, in fact, linked two mountains, Monte Maggiore south, just below the fortified walls of the ancient city of Narni, and Monte Sant'Angelo north towards the plain of Terni.

The current orographic situation was considerably altered over the centuries. About the original site, historians and archaeologists still does not have definitive answers but only suppositions. Since signs of the ancient road are not visible, what was the shape of Via Flaminia from Narni to the entrance of the bridge? What was the route of the Via Flaminia after passing the Nera river? The bridge is aligned with Monte Sant'Angelo but there are no traces of hypothetical tunnels nor piedmont paths linking the bridge to the Via Flaminia in the plain of Terni, at a much

lower altitude than the upper portion of the bridge. An interesting pre-existence, perhaps connected to the road, is the cave of the sanctuary of Madonna del Ponte, discovered at the end of 1700s, with medieval paintings.
Recently, around the cave a church was built digging also a part of Monte Sant'Angelo, which supposedly contained traces of the Via Flaminia.
At the end of 1800s, the construction of one of the first railway lines in Italy, the Roma-Terni, has altered the area significantly, with the partial demolition of the substruction of the bridge and the clean cut between the right bank of the river and the plain of Terni (where today there is the town of Narni Scalo).
So the recent survey of Cecchi had to be completed through new data, using laser scanner and digital photogrammetry (experimental technologies in the early twenty-first century but today widely used).

Survey and technical- constructive analysis

The first phase of the study was the acquisition of metrics information through an integrated digital survey using laser scanner, photogrammetry and topography.
The involved area covers not only the remains of the Roman bridge but also the entire area of the sanctuary of Madonna del Ponte, leaping over the railway. The acquired data also include the interior of the church and the cave with medieval paintings.
This allowed us to develop a model that put in direct relation the whole valley of the river Nera with the remains of the bridge and the inside of the cave, crossing the hilly part (modified at the end of 1800s) that connect to Monte Sant'Angelo.
In total, thirty-one scans were made. For the collimation of the different points-clouds, in most cases we proceeded with the placement of sphere-target for the automatic recognition of the points between adjacent scans. In some cases scans were merged with a manual procedure integrated with target of known coordinates surveyed topographically (Fig. 3).
The first point cloud elaborations made it possible to make some initial considerations on the constructive elements of the remains of the bridge.
The structure of the right abutment appears as the most degraded part of the bridge, with a nucleus almost totally devoid of stone cladding, removed when it was carried out the railway tunnel. The arrangement of the residual stone blocks appears similar to that of the lower part of the left abutment.
An analysis of the remaining structures shows evident constructive and typological differences. There is a different technique of laying in work, probably next to the other, which allows to obtain with smaller amount of material the same result in terms of structural strength, taking advantage of the alternation of 5 parallel rings instead of an arch with constant intrados.
The second pylon collapses on July 17, 1885, due to a river flood. Already in the first representations of '600 its stability appears severely compromised. In this case we have to report the total absence of breakwater at its base. It is also shifted from its original position due to

Fig. 3. Point cloud of the Augustus Bridge. General textured view (by Maiezza, Rossi).

the water pressure. Falling it splits into 3 macro elements and so it is possible to examine in real sections the laying techniques of the ancient time.
With the data acquired by laser scanner it has been possible to survey the main measures of the remains of the pylon but also the smallest details of the masonry equipment. Therefore, the bridge is seen as a strong core walls with blocks exposed in opus quadratum, with rusticated quoins and wedges of local travertine. The connections between the walls are made with metal staples in the blocks, up to the concrete inner core of the wall which consists of lime, sand, stones and travertine splinters.
The third pillar, the best preserved, is stable in its original position and perfectly preserves the outer walls even if deprived of the upper frame. There are clues that suggest its makeover. The second and third arch collapse in 1053, again due to a flood of Nera. Since then, the Augustus Bridge is mentioned in medieval documents as "broken bridge" and to ensure the passage, was built a wooden scaffolding, as shown by the holes in the masonry. It was a temporary solution; so that it was decided to divert the passage on a new bridge, built in 1217 not far from the ancient one.
The remaining arch rests on the left abutment and on the first pillar. This pillar has a protrusion in the foundation without rostrum. The external walls are characterized by the regularity of the alternate arrangement for head and for cutting of the rows, and by an accentuated bevel of the indentation, similar to the lower part. There are pilasters 15cm deep in the corners of each of the four faces; protrude two false shelves, obtained by projecting the "diatono" as support of temporary structures, necessary for the scaffolding of the pillars and for the centering of the arches during construction. Upward the mirror there are two protruding rows

forming a frame made of echinus and abacus. The ring has a round arch, formed by blocks with smooth wedge. There is, on the extrados, a border built by a projecting band aligned to the underlying pilaster, while on the intrados the start of the arc is highlighted by the same protruding band and it extends along the fronts.
Today, the arch has a lowering in key and fractures at kidneys at 36° and 27° from the set plan, side abutment and side pylon. From the remains it is possible to derive the radius of curvature of the second arch by 23 degrees on the set plan. This plan is no longer horizontal because the pylon rotated of 1° to the vertical.
The data acquired by an integrated digital survey, properly processed, led to two-dimensional graphic design and 3D models (Fig. 4)

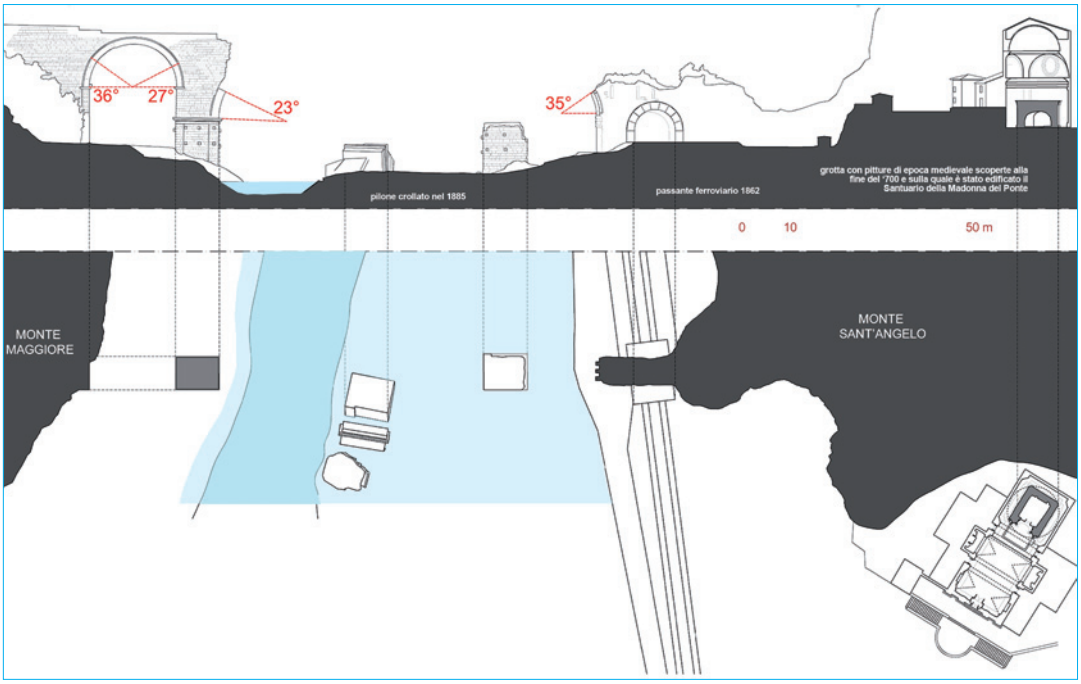

Fig. 4. Graphic restitution of the survey. Floor plan and elevation (by Maiezza, Rossi)

Shape and geometry as the premise of the bridge construction project

Based on the first analysis and considerations described above, certain assumptions have been made about the real shape of the bridge. Particular attention has been given to the geometry of the arches, the slope of the road in the section crossing of the bridge and the relation to two mountainous reliefs south and north. And still to the relationship between the quote of the bridge and the medieval cave, the possible connection with the route of the Via Flaminia on the flat and the current city of Narni. Regarding the conformation of the arches, discarding

the hypotheses made by some researchers about an improbable initial configuration of the bridge with three arches, considering therefore plausible the solution with four arches, we proceeded to a comparative reading of the acquired data on the first arch (that still intact) with the still existing arch parts. Considering the non-horizontality of the set plan, the bulging of the wall facing, the curvature of the arc to the breaking point at kidneys, for the first arch thickness some circles were calculated taking for each circle 3 points identified on the point cloud. In this way, we assumed the most likely arc shape and determined the collapsed pylon position. This is the most important factor of uncertainty, so the successive arches are determined accordingly. Unlike previous studies, rather than proposing metric solution whose values derived from an analysis of the current conditions which have undergone many changes, over the centuries, we proposed a solution that was compatible with the measuring unit of the ancient time, the "Piede romano" (29,65cm). This is because in many architectural works of significant size, and even more for infrastructure projects, it is often found a strong correspondence with the integer values of the measuring unit. It was also found that the measure of the first arch is perfectly compatible with the third arch. The same value of the diameter of the arch would be fully justified in view of the construction site optimization, being able to reuse much of the temporary works of the first arch (Fig. 5).

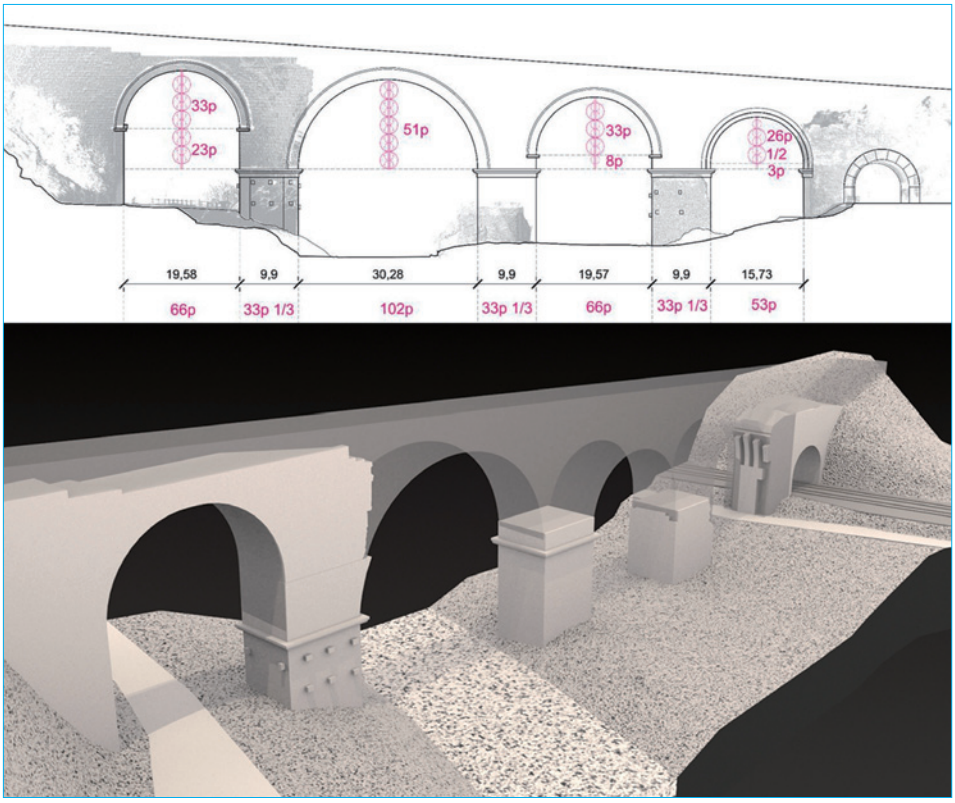

Fig. 5. Hypothesis of reconstruction based on metric and proportional analysis (by Maiezza, Rossi). Elevation and 3D model (by Wahbeh).

It is therefore assumed that this two arches had a diameter of 66 "piedi romani", equal to 19,58 meters, and that the largest arch had a diameter of 102 "piedi", that is 30,28 meters, with a fourth arch of only 53 "piedi". These measures would be perfectly congruent with the findings. The failure of the second pillar, already documented in the Renaissance, and the fact that it has never been documented the presence of beaks breakwater supports the hypothesis that Nera originally had a much smaller riverbed and that this area only interested the second arch.

Conclusions

The use of the most advanced digital techniques for survey and the processing of data acquired through appropriate models of 2D and 3D digital representation, made it possible to formulate new hypotheses on the conformation of the four arches of the bridge and on the probable location of the ancient Via Flaminia. These same models allow today to process a variety of communication strategies based on innovative methods of spread and knowledge not only for researchers but for a diverse audience, showing how, in this case, a careful study of an engineering work might reveal its nature of true work of art, and the grandeur and monumentality of a building can also be done with respect for nature and landscape.

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Archaeological Survey For Understanding Ancient Design: Mixtilinear Pavilions From Hadrian's Villa

Luca Cipriani[a], Filippo Fantinia[*], Silvia Bertacchi[a]

[a] Dept. of Architecture, Alma Mater Studiorum Università di Bologna, Bologna, Italy – (luca.cipriani, filippo.fantini2, silvia.bertacchi)@unibo.it
* Corresponding author

KEYWORDS: Hadrian's Villa, laser scanner survey, geometric analysis, thermal baths, cupolas

ABSTRACT:
Recent studies by the authors based on laser scanner surveys focus on vaulted structures in the renowned mixtilinear halls at Hadrian's Villa in Tivoli, Rome. Such structures are very interesting due to the disruptive constructive techniques as well as innovative designing features by Roman architects to build the most impressive pavilions of the emperor's mansion. By means of accurate and reliable geometric and spatial data gathered during several campaigns, we developed specific methodologies for an in-depth understanding of ancient design behind survived archaeological remains in opus caementicium.

Introduction

Between 117 and 134 AD at Hadrian's Villa in Tivoli (Rome) a large number of vaulted structures completes the most attractive pavilions of the complex: the unusual aspect of those spaces is that they lay on mixtilinear-shape plans and combine both the function of visual focus like canopy at the end of an architectural promenade (complex of the so-called Canopus and Serapeum) and the astonishing opening of hidden domed spaces disclosed after a series of interiors and courtyards Heliocaminus Baths, Small Baths, Piazza d'Oro Vestibule). The development of those innovative coverings is mainly due to the rapid technological progress in the use of Roman concrete (Lancaster, 2005) and the improvement of scaffoldings, centerings, woodworking and at the same time the set of geometrical knowledge allowing bigger dimensions and daring architectural solutions (Moneti, 1992; Opper, 2008; Conti-Martines, 2010). For an in-depth research on the topic, it is essential to support historical information with an accurate survey of those structures, in order to provide reliable 3D models and 2D drawings documenting the state of conservation, becoming proper documents for analysing and interpreting the main geometric features originating the shape and the constructive methods of the ancient design. That has been the main purpose of recent years studies carried out by a team of the Department of Architecture (University of Bologna) on the vaulted structures of the Unesco site (Cipriani et al., 2013).

Methodological approach

One could enumerate various pavilions of the Villa, considering this specific characteristics of

mixtilinear shape, in particular presenting still existing vaulted spaces, such as the so-called Serapeum and the Octagonal Hall at the Small Baths, besides the Vestibule and the southern hall of Piazza d'Oro (Adembri et al., 2014). Taking into account the development of the spatial distribution and of essentially three constructive phases for the Villa, it seems that the constructive solutions adopted in later years were increasingly innovative products not only of the emperor's eccentricity or a blend of architectural influences gathered in travelling experiences, but also the outcome of previous architectural experimentation in similar buildings (as an example the Domus Aurea's octagonal hall). Those models were spread subsequently in Baiae – Hadrian's last residence – as appears in many temples' designing features (Rakob, 1961).
It being understood that each one of the mentioned domes present peculiar features, the Small Baths' Octagonal Hall and what is left of its dome have been deeply studied from the geometric and constructive point of view which shows subsequent events from the original structure until today (e.g. restoration activities and shape alteration in time). This eight-sided space with distribution function in the thermal baths complex has a slightly irregular plan (in the ratio of 1 to 1 with its elevation) and the 3D survey allowed detecting contour lines and cross sections useful for the study of the ancient project through a reverse designing methodology (Adembri et al., 2015), moreover leading to the testing and improving of earlier theories defined by numerous scholars interest in the subject (Fig. 1).

Conclusions

Latest generation devices and surveying methodologies have the twofold purpose of documenting and interpreting ancient architecture: on the one hand three-dimensional data provide reliable documentation of architectural remains and on the other hand the possibility to convert digital models into technical supports for maintenance, restoration and structural assessment, but above all for deepened studies concerning shape and geometric genesis of vaulted spaces. In fact, thanks to information accuracy, more likely reconstruction hypothesis can be developed dealing with structure generation, both in plan and for elevations, contributing to verify scholar's theories and layout grids. Among many examples, the case study presented, after an accurate 3D survey and besides a detailed historic research, has undergone an in-depth analysis on the modular grid based on ancient units of measurement for the design of the complex, especially of the vault, studying in particular the geometric principles for generation.

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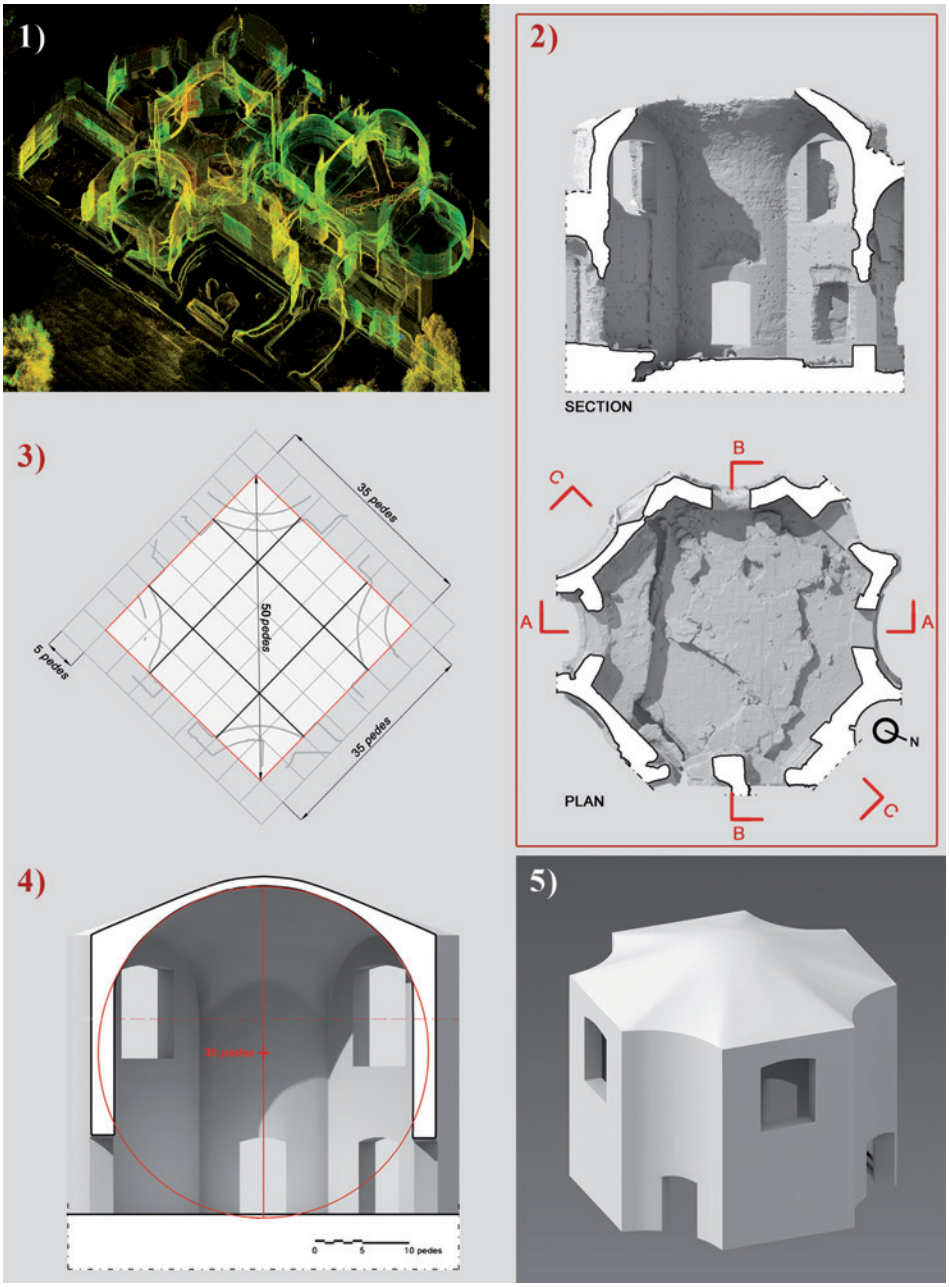

Fig. 1. Workflow of the reverse designing methods for interpreting the ancient design of the Small Baths' Octagonal Hall at Hadrian's Villa. 1) Three-dimensional laser scanner survey of the thermal complex carried out in 2015 for accurate dimensional and spatial data gathering; 2) Digital model documenting the actual state of conservation of the hall, its plan and cross-section; 3) Study of the modular structure supposed to be the basic proportional relationship beneath the designing process and interpretation of the ancient project; 4) Ratio of 1 to 1 between the 35-pedes side of the plan square and the diameter of the dome; 5) Complete model of the hypothesized original hall.

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Laser Scanner & Watercolours. An Integrated Approach to Documentation of Rupestrian Habitat of Cappadocia

Marco Carpiceci, Fabio Colonnese

☞ Dept. of History, Drawing, and Restoration of Architecture, "Sapienza" University of Rome, Italy
marco.carpiceci@uniroma1.it, fabio.colonnese@uniroma1.it

✔ KEYWORDS: Cappadocia, Digital Heritage, Digital Photogrammetry, Watercolours

ABSTRACT

The Open Air Museum of Goreme, Cappadocia, features an extraordinary historical and artistic rupestrian landscape. As part of a national research, the authors have participated in the survey and digital documentation of some of the rock-cut settlements, always with regard to the external morphology, and therefore to the landscape, although indirectly. This paper focuses on the operational practice related to the current digital photogrammetry methodology, as it seems paradoxically to favour a superficial knowledge of the site and to discourage the production of architectural representations useful to the dissemination of knowledge. The authors have performed the measurement activities mostly by laser-scanners and digital photography, and they have produced both models for virtual navigation and architectural representations. At the same time, they have integrated the direct enquiries with drawing from life and have adopted watercolours to enhance the visual models for the communication, in order to enhance both their direct knowledge of sites and the emotional engagement by the public.

Cappadocia between archaeology and landscape[1]

In 1985 UNESCO has inserted the Cappadocia into the list of World Heritage sites. This region of Turkey is characterized by a particular geology as well as a rich cultural heritage. Mostly made of tufa formations, its territory is the result not only of remote geological events but of a double action that every day keeps on shaping it: on the one hand, rain and winds erode the external surfaces; on the other, the communities that have succeeded over time excavate it from within. This double action produces a highly dynamic landscape, which changes almost in real time (Fig. 1). The descriptions by scholars such as Guillaume de Jerphanion (1925-42), who visited the sites almost one century ago, can testify the speed of these alterations. This double action also has the consequence of producing a landscape in which "artificial" and "natural" elements can be hardly distinguished. In many cases, constructors' first approach often consisted in adapting natural conformations to their needs with as less interventions as possible. It is quite common to come across unexpected architectural traces as one walks between the hills and the shrubs. Those traces often look like flat carvings or vertical sections engraved in the smooth stone surfaces that resemble full-size architectural representations but actually constitute the only remains of ancient rock-cut settlements. Most of Cappadocia is a sort of massive artefact, with a formidable social component. Its landscape is the primary formal expression of the collective relationship ex-

Fig. 1. Panoramic view from the top of Ortahisar Castle, near Ürgüp. In the background, the city blocks advancing; in the foreground, ancient and modern rock-cut settlements (Photo by F. Colonnese)

isted between the rocky morphology and the people settled in its folds. André Corboz (1985, p. 24) claimed that "there is no territory without the imagery of the territory" and that this "imagery", which was the cultural foundation project of its many creators, is as important as their either artistic or engineering results. This "imagery" can be investigated only through the "place", as a set of sensitive data, temporal suggestions and cultural assumptions that transcend the space as a simple system of distances. The documentation and reconstruction of Cappadocian habitat must therefore be based on a multidisciplinary study of the site and its environment, by collecting and integrating scientific data. The quest for "inclusiveness", which distinguishes the recent addresses of the Cultural Heritage as expressed by the ICOMOS Ename Charter, requires that the reconstruction of the monumental sites take into account not only all of its aspects (historical, political, spiritual, artistic, etc.) but also the historical interpretations that have occurred over time as well as the cultural and semantic contributions provided by the different groups involved in it. This means that a visual reconstruction should be based on a comparative, detailed and systematic analysis of both morphological and social data filtered by surveyors' physical and mental experience of places.

Surveying the rock-cut architecture: the practice of the laser scanner

As part of a national research, the authors have participated in the survey and digital documentation of some of its sites mainly through techniques of digital photogrammetry. The introduction of laser scanning and LIDAR technology has enhanced the digital photogrammetry and changed the survey practice (Briese and Pfeifer, 2007). As defined by Böhler and Marbs (2002), a laser-scanner uses laser light to measure distances from the sensor to the object in a systematic pattern. Thanks to a combination of a global navigation satellite system receiver and an inertial measurement unit, it provides the user with a geo-referenced numeric model, with position and orientation system, reproducing the architectural body silhouette. The low-cost, portability, and user-friendliness of the latest laser-scanners designate them as ideal tools not only in the rough and dusty rupestrian contexts but in all the situations. Their geo-referencing system has made superfluous any preliminary study of the area as well as any topographical support network. Their scanning accuracy, declinable according to the requirements of the sites, make its results needy of no integration. Their execution speed is legitimising a temporal contraction of the campaign phase, and consequently the associated costs for travel and accommodation while is largely increasing the time for post-processing data and elaborating representations.
The use of these techniques of digital photogrammetry seem particularly appropriate to enquire the rupestrian habitat. The sculptural nature of the underground settlements can be easily scanned and reproduced through point clouds which reveal, for the first time, the "true form" of these "informal" architectures. The assembly of point-clouds offers a global numerical model of the site that not only reveals unimaginable

shapes and alignments, providing the scholar with a radiographic "bird's eye view" of underground rooms, (Fig. 2) but also guarantees a faithful and unfading memory of rocky

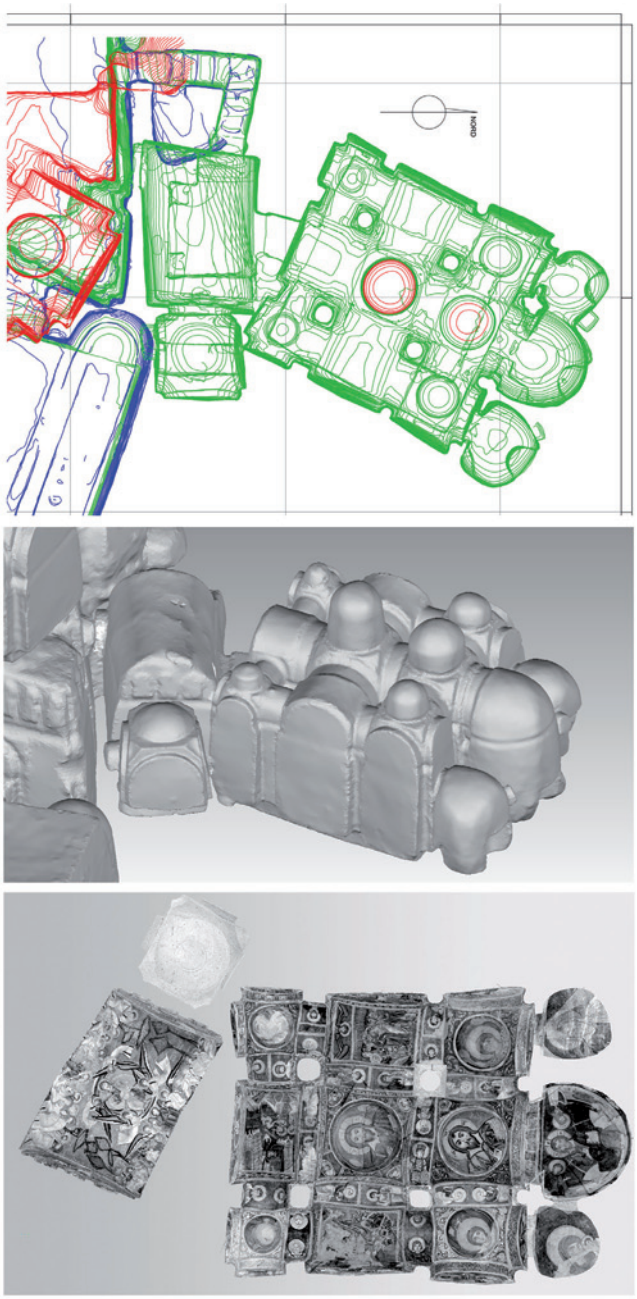

Fig. 2. The Dark Church (Karanlik Kilise) in Goreme, XI century. Above, plan by contour lines (colours identify the main levels of settlement); middle, intrados meshed model after laser scan; below, photographic mapped ipografia (Elaborations by M. Carpiceci)

structures even after erosion or wear produced by mass tourism will decree its collapse. In the current practice, surveyors use to get into a room, place the tripod with the laser-scanner in the central part of it – being careful to its alignment with neighbouring rooms through openings –. Then they let the scan start and they get out of the room to disturb the machine as less as possible, waiting nearby for the acoustic beep announcing the end of scanning. Then they get back into the room, take the instrument away and move it into the next room, occasionally relocating one or more of the reference spheres used to help the post-assemblage of several point-clouds.

Survey to learn and disseminate knowledge

Today, both the act of surveying and the final visual results of it happen to be identified simplistically with a largely automated process of acquisition of point clouds measured in polar coordinates. Instead, the survey cannot but be the result of a slow and iterative knowledge process. "To measure an architectural event," Giancarlo De Carlo wrote, "is to bring it back to the size of your body and understand it, as well as with the mind, with the senses: only then you appreciate the size, and also the quality of a place; measuring because it captures all through the details and vice versa." (De Carlo, Buncuga, 2000, 30). This "slow process" is made of a sequence of interrelated steps:

- the surveyors acquire information about the site, through bibliographic, archival, and web research;
- they get in touch with the site: a contact which at first is only visually and gradually becomes physical and mental;
- they become familiar with the subject generally by taking pictures of it, up to gradually approach a systematic photographic survey;
- they draw up the first sketches, through which they gradually turn the material into margins, the rocky wall into surfaces, the edges into lines, the physical place in geometric space, the graphic and mental model of it;
- by taking the early measures, they remove the aura halo that inevitably surrounds a monument and may corrupt its reception.

This practice of direct surveying implicates a greater mental and operational approach that requires preliminary studies and, above all, the formation of a mental model of the site. It is evident that a laser scanning offers a very different operating scenario in which this structured, active and synchronous process of knowledge might be seemingly avoided while an asynchronous and mediated process is indirectly favoured. Even if no digital simulacra can yet replace a direct bodily experience of a place, the direct enquiry is *de facto* moved from the field survey to the laboratory stage. Secondly, this also affects the quality of the final representations, often entrusted to automatic visual models rather than to traditional graphic outcomes which are more efficient in the dissemination of knowledge (Fig. 3) but also harder and longer to be produced. (Colonnese, Carpiceci, Inglese, 2016)

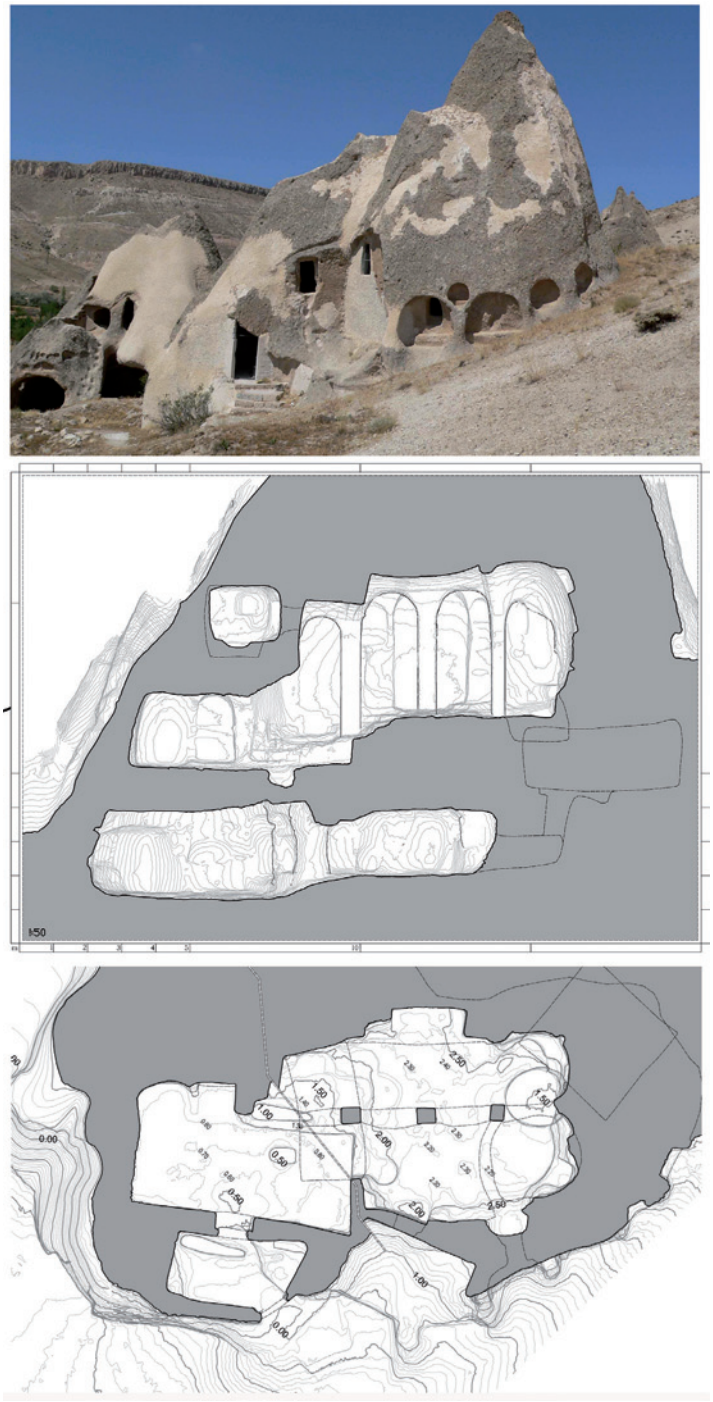

Fig. 3. The Forty Martyrs' Church in Sahinenfendi, c. 1216. Above, the cone of the church; below, longitudinal section and plan by contour lines (Photo and drawing by M. Carpiceci)

In this massive mechanisation of the process of survey and representation, in the campaign stage the gaze and the body of the scholars become more and more passive. They are no longer motivated by the emergency to know, which settled them in a kind of permanent challenge with the place, forcing them to invent and experiment procedures and models. They seem quite satisfied to entrust all of the job to a machine and to accept its results that seem to implicitly ensure the most of the potential knowledge.

Integrating the surveying and the survey

Beyond the limitations related to its actual position in space (for example, the difficulty of scanning surfaces from above), the use of laser-scanner appears today "necessary and sufficient" in any situation. Yet, even in measuring distances and reflectance value of the points, the laser-scanner is neglecting something. Conversely, although the integration of data from different techniques and instruments requires complex operation, it implicitly offers a multiplicity of visions that induces a critical (multidisciplinary) enrichment. It is therefore always advisable to complement the mechanical eye of the laser-scanner with other approaches which can read and integrate the uses of space and materials that determined this form of landscape. In the absence of preliminary investigations, the laser-scanner can be associated to much more traditional drawing and watercolour. (Fig. 4) This practice offers a number of opportunities:

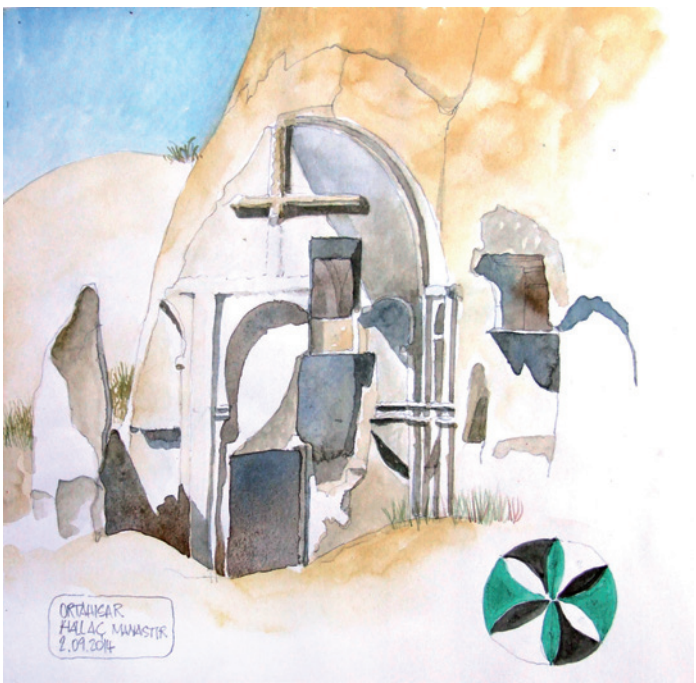

Fig. 4. The Hallaç Manastir, Ortahisar (Watercolour by F. Colonnese)

- the knowledge increasing is constantly fixed on paper and favoured by the dialogue between the sign and the subject;
- it encourages the critical reading of the surfaces and spaces through the dimensional and proportional filter of the human body, which is imprinted in the consciousness of the author;
- it prefigures the data into visual information to guide the post-production;
- it can be carried out during the scanning periods, without affecting nor the digital survey results, nor the overall timing of the field survey.

In parallel to the processing of the chromatic data, and the understanding of their architectural role, the chromatic knowledge adds a further cognitive factor of reality. Although photography is an indispensable tool for a scientific survey of the Cultural Heritage, the current limitations associated with the instrument sensitivity and the apparent brightness (Carpiceci and Colonnese, 2014b) force operators to develop "tailored" procedures as well as to complement the colour detection with conventional technologies. Where a scanner optically "breaks" a monochromatic object into surfaces with different colour values, an "archaic" technique as the watercolour, joined to the scholar's sensitivity, is capable of recording the different colours as brightness variations of a single mono-material body. One only needs to apply a method that allows a "faithful" recording of the chromatic data, such as that for suggested by John Ruskin, more than 150 years ago (Carpiceci and Colonnese, 2014). This activity can be executed with regard to communication, the type of knowledge to convey and the type of target. In the last decades, the spread of digital products in all of visual arts' fields has radically changed the status of traditional graphic products, which are increasingly perceived as valuable art pieces. Such traditional graphic products can be then used to contaminate the digital outcomes after photogrammetry and photography (Fig.5). Moreover, in the current context of Virtual Heritage, in which visualisation experts borrow narration pattern and game strategies from cinema and video games (Pescarin, 2014), tools such as the travel sketchbook and watercolour possess an emotional communicative potential able to engage the public. In fact, they can convey concepts like:

- the idea of man as the actual maker of the documentation and reconstruction process, despite the "synthetic" appearance of the most advanced multimedia products;
- the "human scale" that shaped the rupestrian landscape and rock-cut architecture;
- the man's "point of view" that conceptually produced the cultural bases of landscape in the consciousness of the community that inhabits and uses the territory (Turri, 1998).

Conclusions

With regard to its origin as a structure directly obtained *in* and *with* the territory by subtraction and displacement of rocky matter, the rock-cut architecture is a limit case in itself and requires multidisciplinary approaches and integrated surveys. The drawing from life and watercolour are techniques which, when associated to the recent digital photogram-

Fig. 5. Integration between techniques. Above, Aynalı Kilise Monastery, panoramic view of the vinery made by moving along a line; middle, fusion between a picture and a watercolour of a rock-cut hall; below, comparison between a picture and a watercolour of surveyors working (Watercolours and elaborations by F. Colonnese)

metry, allow a deep contact with the subject and contribute to trigger the circular cognitive process that feeds a proper process of survey and representation, through which the scholars may identify themselves with the constructors and users of those places. In addition to this, the results of this practice can ensure an emotional relationship with the

site which may be significant also in the involvement of future users of digital archaeology. In this age of "democratisation" of the world's documenting, in which the spread of geo-referenced digital cameras, low-cost drones, high-speed network and friendly-user software for photo editing, assembling and visual-editing let almost anyone collect, manipulate and disseminate data, operators and scholars can no longer be like "priests" who own and distil knowledge in exclusive conditions and contexts. They should rather be a shaman and a scientist fused together. On the one hand, they must fasten the link between the body and the place as well as between the fantasy and the landscape cultural fundaments; on the other hand, they have to emphasize the strict relationship between data collection, scientific hypotheses, visual reconstructions and sustainable and eco-compatible enhancement plan.

Notes

[I] This paper is the result of the coordinated work of the authors. In particular, M. Carpiceci edited the from *Introduction* to *Survey to learn...*, while F. Colonnese from *Integrating...* to *Conclusions*.

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Virtual Models For Archaeological Research and Dissemination: Current Needs and Challenges

María de los Ángeles Utrero Agudo[a], José Ignacio Murillo Fragero[b], Rafael Martín Talaverano[b]

[a] (Marie Skłodowska Curie – IF, Durham Univ.)
[b] (Urbe pro Orbe Patrimonio Cultural, Madrid)

KEYWORDS: 3D models, Archaeology of Architecture.

Introduction

Digital technology for survey and modelling of historical buildings has been largely improved during the last years, and 3D models are nowadays more realistic, accurate and rigorous. It is commonly assumed that these digital tools are quite useful for both research and dissemination. Nevertheless, our personal experience aims us to nuance such issues, in order to clarify the use and future development of 3D models. The main objective of this text is therefore to show some ideas in relationship with the use of such virtual models, based on the results of a wide range of archaeological research projects (summary in Caballero 2010).

The archaeological research of historical buildings

One of the distinctive features of historical architecture is its evolutionary and multi-stratified essence, since it is the result of a long process of successive transformations which have taken place throughout its history. Beyond the traditional concept of model building, which was built in a precise moment and is artistically catalogued within a unique period, the real building concept provides an innovative vision based on its transformation sequence, recognizing the different buildings comprised within one single structure (Caballero 2010). The so-called method of the "archaeology of architecture" approaches the construction like an excavated site, allowing thus to elucidate the sequence of transformations of the building and to understand the evolution of the society that used and lived it.

Application of virtual models for the archaeological research

3D models of historical buildings have become a powerful and quite popular tool which is supposed to offer great advantages regarding the research process and the dissemination activities. In our opinion, the analysis of the building by means of the archaeology of architecture does not need any 3D representation to be properly done, but just a complete and rigorous

group of architectural drawings, such as horizontal and vertical sections as well as the external façades. Contrary to the common opinion, we think that 3D models are not yet research tools themselves, because their geometrical information is not easily accessible enough and the spatial and geometrical analysis can be much more achieved by traditional architectural drawings. Nevertheless, in some particular cases the 3D model itself can provide a significant support for the constructive analysis, especially when comparing the spatial configuration of some unrelated elements, checking the volumetric compatibility of the hypotheses regarding the study of currently lost spaces and undertaking the pathological analyses, since the distortion of walls and piers may be checked everywhere.

All in all, we consider that 2D architectural drawings are still the main research tool to analyse historical buildings (Caballero and Murillo 2006, Martín Talaverano 2014). 3D models are being increasingly more important to obtain such drawings, and what is more significant, they become a full record of geometrical data of the whole building. This is, in our opinion, one of the main advantages, given that they make possible obtaining further drawings and geometrical, constructive, structural and pathological analyses subsequently by other researchers different from the authors of the initial data acquisition.

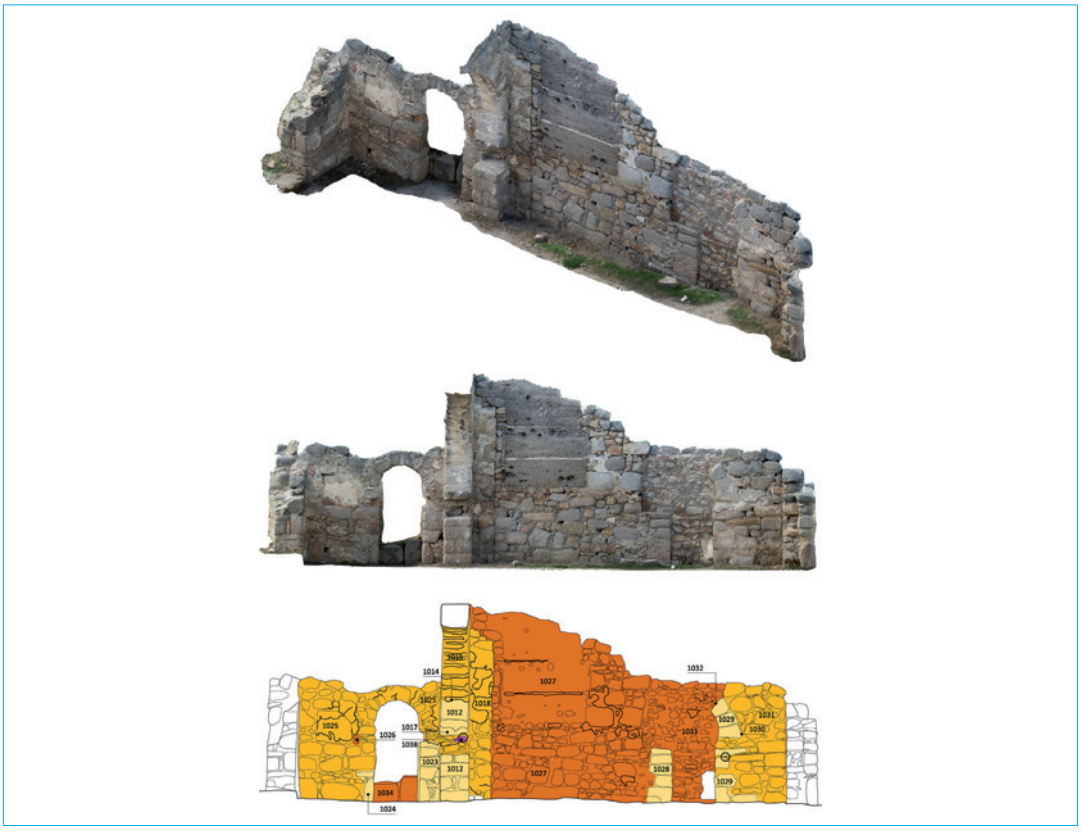

Fig. 1. 3D model and 2D ortophoto and analytical drawing of San Pedro de la Mata Church (Utrero M.ª A., Murillo J. I., Martín R.)

Application of virtual models for the dissemination of historical architecture

The comprehension of a whole spatial structure by using planar projections (plan layouts, vertical sections and external façades, for instance) is not an achievable challenge for many non-specialised people. That is why 3D models certainly provide a quite important help to physically view and understand buildings.
Furthermore, virtual reconstructions of lost or hidden architectural elements are sometimes essential to make people visualize them. However, such virtual reconstructions usually offer opaque and hermetic interpretations, and it is almost impossible for anyone, apart from the author, to understand the outputs of the analysis undertaken and on which hypotheses are based such interpretations. In order to open up a transparent methodology to generate 3D models showing the research process and its results, there must be a strong link between the physical object (data) and the virtual reconstruction (interpretation), establishing meaningful narratives beyond the traditional "opaque" and "closed" current models.

Conclusion: Specific challenges to be addressed for the future development of virtual models as digital dissemination tools

To sum up, we consider that it is crucial to clarify two critical aspects regarding the use of 3D models for the archaeological research and dissemination. First of all, we would like to underline that such virtual models have to be accompanied by a complete set of proper 2D traditional architectural survey in order to be useful analysis tools.
Secondly, an adequate development of further virtual reconstructions of lost architectural elements should take into consideration their transparency, using the powerful digital resources that modern technologies offer us. In fact, we consider that accessibility should not only be referred to the physical or technological ability to get and share data, but also to the opportunity to access to other kind of information beyond the results, so that users would be able to understand the whole research process.

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Experiences of Predictive Archaeology

Marta Giani

School of Science, University of Bologna, Italy

ABSTRACT

The aim of this paper is define the most important features of Predictive Archeology and group some significant experiences about the last twenty years.

Predictive Archeology has become an indispensable tool for the conservation of archaeological heritage. The ability to identify *a priori* the *archaeological potential* of a specific area is typical of Predictive Archeology as well as the needless to intervene on that area with any type of construction project or archaeological dig. Predictive Archaeology has a contrasting potential to the Preventive Archaeology. The latter is linked to the concept of *archaeological risk* which involves the estimate of money and of damage that a construction project may cause to the buried archaeological heritage. As a consequence, it is connected also to the definition of the measures that must be taken to safeguard the remains: from the prohibition to carry out the work to the prescription of Preventive Archaeological investigations.

The Archaeological Potential Map is an archaeology tool that intends to support the present, letting it proceed towards the future without forgetting the past: whereas in the Archaeological Map we record all the information obtained from the excavations, from the literary sources, archival documents, aerial and satellite photos, the Archaeological Potential Map is able to provide information – albeit hypothetical – even on those portions of territory not considered in the Archaeological Map, since they provide no information about any buried remains. In a sense, the Archaeological Potential Map uses the Archaeological Map as the base and adds to it supplementary historical and archaeological information data of a different kind such as geological and geomorphological, toponymy analysis, historical registers and urban constructions.

Subsequently, this permits the calculation based on codified interpretative models (statistical and/or mathematical) that allow to predict the possible archaeological remains on areas for which no information of any sorts is available. In practice, the archaeological knowledge related to specific areas allow us to make assumptions about the existence of archaeological remains buried in neighboring territorial portions, neither investigated nor with a higher accuracy, depending on the amount and quality of information available (Leusen, M. van - Kamermans H., 2005, *Predictive Modelling for Archaeological Heritage Management: A research agenda*, p. 28).

The prediction in archeology field presents a lot of advantages. For instance, it can guide the design of urban development in cities and rural areas with total respect for archaeological heritage (Bakers C. C. - Kamermans H., 2007, *Case Studies in Archaeological Predictive Modelling*, p. 13-17).

Some examples of Predictive Archaeology

1. Canada, in the 80s, was interested in industrial expansion that affected the boreal forest of Alberta. The deforestation and reforestation operations were very intense and caused considerable disturbances to the few existing archaeological traces relating to sub-Artic ancient population Athapaskan and Algonquian. Since the 90s, the necessity to export products to foreign markets led to an ideological shift. The administrative responsibility was privileged compared to intensive use of the land, non-economic values were reassessed, the culture of aboriginal Canadians and preservation of the historical tradition were integrated within the design plans for the development of the forest. This demanded a necessary tool capable of foretelling the existence of historical and archaeological sites,

and this is where the best utility of the predictive map fits in. After an initial, intuitive approach, the provincial administration's commitment adopted statistical approaches and the use of GIS for the modeling. The WHS (Western Heritage Services) became the largest producer of potential models for heritage that developed the novel digital modeling methods.

Environmentally deterministic models have been designed by the landscape and not by cultural elements such as, for instance, places for religious cults. The site to be predicted was defined by the direct influences of the boreal forest on subsistence practices and general mobility. Then the model was refined by feeding new data and improved further in an alternative manner (Leusen, M. van - Kamermans H., 2005, *Predictive Modelling for Archaeological Heritage Management: A research agenda*, p. 205-221).

II. The Netherlands is the first European country that used predictive models. In the late '80s, the predictive models were made exclusively on a local scale by RAAP (Archaeology Consultancy of the Dutch AHM) that supported the strong American influence method. However this method was not suitable for the Dutch archaeological context, especially for the lack of reliable archaeological data due to the typical invisibility of the Netherlands' traces. In 1997 the first predictive model on a national scale was born, it was made by IKAW (Indicative Map Archaeological Values). The Dutch public archeology faced a paradigm shift in 2002, with the implementation of the Valletta Convention. The government decided to restructure archaeological heritage management to allow a gradual demand for archaeological market.

The Netherlands plays a fundamental role in the production of predictive maps, certainly for the display of archaeological values and the development of a planning tool.

From the purely archaeological point of view, predictive modeling was the key-tool for the "invisibility of the Dutch archive traces" (Bakers C. C. - Kamermans H., 2007, *Case Studies in Archaeological Predictive Modelling* p.18). In fact, it refers not only to the ground, since the visible monuments themselves, in a sense, can appear "invisible" due to their rarity, to the intense cultivation of the landscape and, above all, to a typological-set extremely limited. The general lack of data is linked to the few and concentrated information acquired for the periods of Neolithic, Iron Age and the Late Middle Ages: the predictive model could be able to balance the deficiencies to offer a wider and more consistent framework. The review and the update of a previously used model for Rijssen-Wierden area in the east of the Netherlands has led to the creation of the first Dutch predictive model.

To generate a predictive model the correlation between landscape and prehistoric settlements was investigated, comparing the characteristics of 76 settlement or burial sites with 80 random check points, using a raster resolution of 100 m. Subsequently, the archaeological sites were divided into five historical periods, and once placed in relation with eight environmental variables, they exhibited significant connections. Certainly the
new data and sites (visible) have led to discrepancies, but that does not omit the possibility to recalculate the model to achieve a new map, more accurate (*Ivi*, p.18-20).

III. In February 2000, a project for Brandenburg (federal state in the northeast of Germany) was initiated. The predictive modeling Archäoprognose Branburg was built, thanks to the collaboration between Brandenburg State Authority for Heritage Management, the State Archaeological Museum in Wünsdorf and the Department of Prehistory of the University of Bamberg. The real needs of the predictive model concerns the laws of the State: any developer who wants to implement a project in Brandenburg must take protective measures and consider in its budget a sum to be used exclusively to archaeological rescue in case of destruction during the work. The managers have to precisely specify the amount request and the time profile of the excavations at the outset. In case of areas where archaeological remains are buried and uncertain, the forecast of the work would be really difficult.
The Brandenburg's database was organized in two groups of different sites, before and after 1980, two independent data sets of approximately equal size and quality. The model has been calculated only on the basis of before-1980 data and the control was made up by comparing the model with after-1980 data: the reliability of the prediction of the sites was above 80%.
Today it exists as the more detailed predictive model. The excellent quality of the data (even if it has been important to control the amateur investigations and the information provided by the activity of lignite extraction) is due to the central role of Brandenburg in different historical moments. Hence it was possible to make use of many available information. The data were digitized and converted to GIS layers, a hardest part of the job as the historical material are not conform to modern mapping standards. Once the data has been collected and processed, the model building phase started (Leusen, M. van - Kamermans H., 2005, *Predictive Modelling for Archaeological Heritage Management: A research agenda*, p. 93- 109).

IV. In 1996, the *Service Régional d'Archéologie* (SRA) of Lorena region (France) decided to start a project to catalogue the distribution and conservative state of archaeological sites in which Roman furnaces for ceramic production could be found. The founding reason behind the project is related to the rapid changes that started to affect the area of Argonne. The SRA of Champagne-Ardennes region decided to adhere to the project. In 1997, a detailed study covering an area about 725.62 km2 became necessary. To probe such a massive spread of area, a predictive model was in high demand. In archaeological context the Argonne region was very active during the Roman Period due to the exportation of industrial quantity of ceramic products, including fine ceramic slip wares, which were used for dating the sites and the producer centers. Since the first century there had been also the production of so- called Belgian pottery and subsequently, red pottery, black *sigillata* and common coarse pottery.
Until the beginning of Argonne Project, the knowledge of the distribution of the oven-sites was very scarce. Hence only 30 sites were listed in the French national archaeological database, the DRACAR. The first model was not satisfactory due to the scarcity of data.

An increased number of sites was essential to produce statistically meaningful analysis. Further recons provided the construction of a good model from the point of view of the cultural heritage management (Bakers C. C. - Kamermans H., 2007, *Case Studies in Archaeological Predictive Modelling* p. 29-40).

V. Between 2011 - 2013 the University of Pisa developed a project (MAPPA) to design a new model, a general theoretical instrument, capable of repeated usage with wider applicability in multiple Italian realities (Gualandi M.L., 2012, MAPPA. *Methodologies Applied to Archaeological Potential Predictivity*, vol. I, p.17). Unlike the models mentioned above, this tool is not limited to a particular city. The work of the MAPPA Project, a collaboration between archaeologists, mathematicians and geologists, resulted in a tool capable of predicting areas of archaeological potential and guiding the choices of public and private interventions (i.e., occupations and constructions). The tool was developed using an interdisciplinary approach by integrating the inputs of experts from multiple research disciplines. This project became mandatory to regulate the efforts of the municipality towards effective heritage protection. This was important for a city, especially like Pisa, where the archaeological heritage resides at the city center and well overlaps with the densely populated locations. The need for a defined procedure, a clear and focused path for the protection of Italian heritage led to the germination of the project. This ultimately resulted in three fundamental outcomes. First, the Archaeological Potential Map that helped to drawn predictions on unknown areas, thereby paving the way for an effective city development plan and respecting its past heritage, even if unknown (more details can be found on-line at http://mappaproject.arch.unipi.it). Second, an ad-hoc algorithm for both the calculation and automatic validation of archaeological potential. It permits the removal of a bit of subjectivity, it is repeatable and, therefore, applicable to cities with similar characteristics of Pisa (quite common in most of Italian cities) in any context. Finally, the MOD, the first archaeological archives marked by open date criteria. The system guarantees the authorship of the data, thanks to the DOI codes (the equivalent of ISBN for books) and thanks to the Creative Commons Licenses.

Conclusions

In the 80s in America, following the numerous government projects on land management, an ideological change was seen to protect the heritage sites, which impacted, in a good way, the course of archaeology.
Assuming that these sites have specific relationships with some environmental characteristics, it was possible to construct interpretative models (statistical and / or mathematical) that allowed hypotheses on the probable archaeological remains in areas never investigated or investigated with lower accuracy. The applicability of the models varied depending on the amount and quality of the available information.
Since then different countries have taken the advantage of using the predictive models. The reasons begin that the models are specific to each site and/or conditioned, oriented by

variables such as the geographical location, geological/geomorphological features, legislation, etc. One can use a predictive model that is either specific or repeatable (thanks to the work of the MAPPA Project). The product validation is reflected by the extensive benefits it entails by combing the preservation of historical and archaeological heritage in compliance with the modern society, influenced by time and money.

The achievements of the decades of efforts led to regard the ground we step in every time as a rich source of information, a huge "encyclopedia" full of unconscious traces - for this reliable – fundamental for the reconstruction of historical contexts.

The storage of archaeological information under the ground offers an advantage of being an almost inexhaustible mine. However, irreducible urban developments and high demands of everyday life can mutilate such a valuable resource.

Herein the models, without opposing the inevitable development of urban and rural areas may be considered a guideline tool in assessing the impact of a work. The models represent the means for a different collective awareness of the importance of the cultural heritage, the starting point for the development of protection.

The achievements made so far are remarkable although all perfectible. The ongoing progress in predictive models approach needs further investigation but to quote a recent example: how would the archaeological work of Plestia take place if the SS Civitanova-Foligno had made use of a predictive model? The question is whether avoiding "the unexpected surprise" of time, costs and safeguarding of the site would have been favored.

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Retracing Ancient Roads: Reconnaissance and Three Dimensional Topographical Surveys in the Via Salaria Project

Michele Silani[a] *, Enrico Giorgi[a]

[a] DISCI, Dept. of History and Cultures, Section of Archaeology, University of Bologna - (michele.silani2@unibo.it, enrico.giorgi@unibo.it)
* Corresponding author

KEYWORDS: via Salaria; Tronto River; laser scanning; photogrammetry; 3D modeling.

ABSTRACT

The paper presents the first results achieved within the Project Via Salaria started in 2015 by the University of Bologna (DiSCi). The new research is aimed at the reconstruction of the ancient route by means of topographical analysis and study of the archaeological remains still surviving, as well as at the detailed and complete recording of these remains having recourse to modern technologies of 3D documentation and virtual modeling.

Besides the accurate positioning (with DGPS) of all the preserved traces along the road, the more recent activities have also included the laser scanning and photogrammetric 3D survey of the outstanding evidence and monuments (i.e. the bridges across the Rio Nile and along the River Tronto at Arli).

The first steps here exposed represent the starting point for both the study historical and archaeological of the ancient Via Salaria and as a springboard for the development of virtual tours, in the direction to enhance this important heritage, promoting activities of slow tourism and cycling holidays.

The drafting of the present article takes place in a particularly touching moment for those writing it. The geographical area researched was in fact hit hard in the last few days by a very strong earthquake that destroyed some towns located along the route of the Via Salaria. For people like us who were born here and have lived in these places, or have visited them frequently over the years, the sense of emptiness, powerlessness and desperation is overwhelming. In a small way, we hope that our research can contribute to keeping the memory of these lands alive and at the same time enable their rebuilding in the years to come.

The Via Salaria project developed out of a collaboration between the Topography Laboratory of the Department of History, Culture and Civilizations, Archeology Section of the University of Bologna, directed by Prof. Enrico Giorgi, the Archeology Superintendency of the Marche region, represented by the local official Dr. Filippo Demma, and by the institution ANAS Ancona division, which manages the Italian roadways.

This collaboration is the result of a synergy among institutions of research, promotion and management of the territory that does not happen very often and that appears to be a good omen for the continuation of studies here.

This project is in fact in its early stages and is meant to develop into two lines of research and investigation.

The first is linked to a detailed reconstruction of the ancient route of the Via Salaria by way of topographic analyses and the archeological study of conserved artifacts.

The second line involves the creation of a detailed documentation of these archeological remains through three-dimensional surveys and virtual reconstructions not only to study the building techniques and carry out structural analyses, today of particular relevance in relation to current events, but also to promote this heritage both for its conservation and for tourism in this area.
In the month of February 2015, the first topographic reconnaissance campaign began along the part of the ancient Via Salaria located in the Marche region.
More specifically, the area of study includes the part of the ancient Via Salaria that runs from Colli del Tronto up to Arquata del Tronto, in the province of Ascoli Piceno.

(E.G., M.S.)

The Via Salaria and its branches in Ascoli Piceno

As many people already know, the road that even today is known as Via Salaria, modern day SS4, runs over large tracks of the ancient Roman road with the same name. This large road was the result of the reconfiguring of some very old pathways that linked the costal area with the Apennines into a single road. Crossing through the gully of the Velino River, the Tiber valley, on the side of the Tyrrhenian Sea, was connected to that of the Tronto, on the Adriatic coast, thus creating a road that allowed for the entire peninsula to be crossed from west to east. This is still the main function of the SS4 today.
In particular, the Marche region section of this route is home to some noteworthy examples of well conserved and lasting works built by the Romans especially during the Augustan age.
Despite all of these finds, this infrastructure has not always received the attention it deserves. It is enough to note that since the first systematic investigation carried out by Nicolò Persichetti at the beginning of the last century (Persichetti, 1904) the next one was not done until the 1980s by Gioia Conta, with the help of the Ascoli natives Seghetti, Guidotti and Caucci (Conta, 1984). In the time between these two investigations, many artifacts were destroyed and this dynamic has not stopped even today, as the quantity of archeological finds still visible today is considered to be approximately half of what it once was.
The Tyrrhenian section is well known thanks to numerous literary references and is commonly considered to be the oldest, given that the name Salaria, most likely referred originally to its function of connecting the interior towns to the salt flats (*saline* in Italian) of Ostia and therefore to the salt trade in this region.
The Via Salaria led out of Rome, while the route up to Ostia was along the Via Ostiense. The Salaria left Rome at Porta Collina and went up along the right bank of the Tiber River, crossed the Via Nomentana at Monterotondo (in *Eretum*), reached Rieti at the forty-ninth mile and in Antrodoco it forked: one branch leading further south (known as Via Cecilia) went towards Aquila (*Amiternum*) or Teramo (*Interamnia Pretuttianourum*) up to the sea; and the other went up the gully of the Velino River and into Ascoli territory.
We must also assume that the Piceno section was used in antiquity, even if we do not have any clear references in written sources. Probably this route had a strategic role in the early phases

of Roman expansion into Piceno, starting in 284-283 BC. Nevertheless, a real unitary program of infrastructural remodeling must have been undertaken only under Augustus, as seen by the milestone markers (in Trisungo and Marino del Tronto) and by the many monumental remains (bridges, terracing, roads cut directly into rock).

The route of the Salaria and of its branches in the Valley of the Tronto can be reconstructed thanks to the analyses of many different sources, from itinerary texts (Antonine Itinerary and Tabula Peutingeriana) to archeological ones (milestones and infrastructural remains), and even toponymic ones. Everything rests, however, on the examination of the historic evolution of the physical geography, because it was the careful reading of the physical environment that determined the choices made by the Romans.

A lead in reconstructing the route can thus be found in considering the ancient itinerary texts, which describe stops and intermediary distances. It is evident that pinpointing the various sectionsis fundamental for the study of this route, given that it is then possible to link the current locations to those cited in the ancient toponymy documents.

In the territory of Ascoli, the pathway of the Salaria can be reconstructed by reading the *Itinerarium Antonini* (307,3) and the *Tabula Peutingeriana* (V, 4). The section running through Ascoli appears only in the *Itinerarium Antonini* and ends in *Castro Truentino*, which corresponds to Martinsicuro today. As for the rest of the route, the two itineraries contain references that date back to the 3rd and 4th centuries AD, respectively, with a few differences. It has been noted that the only way to reconcile the two itineraries is to consider there being an error in the writing of the *Tabula*, usually less reliable than the *Itinerarium*. On the basis of a few possible paleographic corrections and a careful topographic consideration, it is possible to put forth the following summary table of the itinerary sections of the Salaria in the Piceno territory (Dall'Aglio, Giorgi 1999) (Table 1).

Town	Relative distance	Miles from Rome	Miles from Rome
		(It. Ant.)	*(Tab. Peut.)*
Falacrino (Torrita)		*LXXX*	*LXXXII*
Vico Badies (Fonte del Campo, Accumoli)	*VIIII*	*IXC*	*XCI*
Ad Martis (Campi di Sotto, Tufo)	*IIII*	*XCIII*	*XCV*
Ad Centesimum (Vezzano, Pescara del T.)	*VI*	*IC*	*CI*
Surpicano (San Salvatore, Arquata)	*I*	*C*	*CII*
Ad Aquas (S. Maria, Acquasanta)	*VIIII*	*CIX*	*CXI*
Asculum (Ascoli Piceno)	*X*	*CXIX*	*CXXI*

Table 1. Summary table of the itinerary sections of the Via Salaria (from Giorgi 2014).

In light of these analyses of the itinerary sources it is possible to reconstruct the route of the Salaria in Ascoli more in depth by integrating this reading with the contribution of the evidence contained in the archeological artifacts (Giorgi 2014).

The new project: reconnaissance and three-dimensional surveys

In fact, the archeological relics present in the section running from Colli del Tronto up to Arquata del Tronto were the focus of a new documentation and recording project. In terms of methodology, the first step of this research project involved a careful analysis of all the archive data present in the archives of the Archeology Superintendency of the Marche Region and in local archives. For every site, all of the bibliographic and photographic data available were gathered. Subsequently, all of the information gathered was verified in the area by way of site-specific investigation. In this way it was possible to check the state of conservation of each artifact and proceed in the most important and monumental cases with more detailed topographic surveys. All of the information collected was put into a specially created catalogue form made using commercial software (*FileMaker Pro 10*) which can be connected to a GIS (*Geographic Information System*) for spacial definitions. On the forms, besides the location data, all the bibliographic and photographic information collected was also inserted (Fig. 2).
Locating sites was done using differential GPS (*Topcon Hyper Pro*) both for emergent or single point (comprehensive) finds and for conserved artifacts. With traces, cinematic surveys were carried out. In both situations, post-processing elaborations were done to obtain sub-centimeter precision both in terms of planimetry and height.
More specifically, in the first phase, some datum points were established along the valley connected to 5 vertices of the IGM 95 geodetic network, using a static survey. The elaboration of the planimetry was done using the software *Topcon Tools v.8.2,* while for the calculation of the orthometric height, local grids were used and the software *Verto 3K*. Next, the new datum points were used as positioning points for the detailed surveys, one individual point for single point discoveries or closed polygons framing the most important archeological finds. The results obtained in terms of residual errors were compatible both in terms of their correct georeferencing with the GIS and regarding the absolute positioning of the detailed topographic surveys done using a laser scanner and photogrammetry.
For all of the points established, detailed monographs were created, where the coordinates of the main national reference systems were indicated (geographic coordinates: ETRS89, plane coordinates: Monte Mario - Italy Zone 2 Roma40, ETRF 2000 TM33) (Fig. 3).
During the second phase of research, carried out for some significant cases, detailed surveys were done with a laser scanner with different phases, *Faro Focus 3D Cam2*, and image based photogrammetric surveys were done using the technique of structure from motion for the creation of three-dimensional models.
With these techniques, the bridge on the Rio Nile, a left side tributary of the Tronto River, and the abutment of the bridge over the Tronto River in Arli were surveyed.

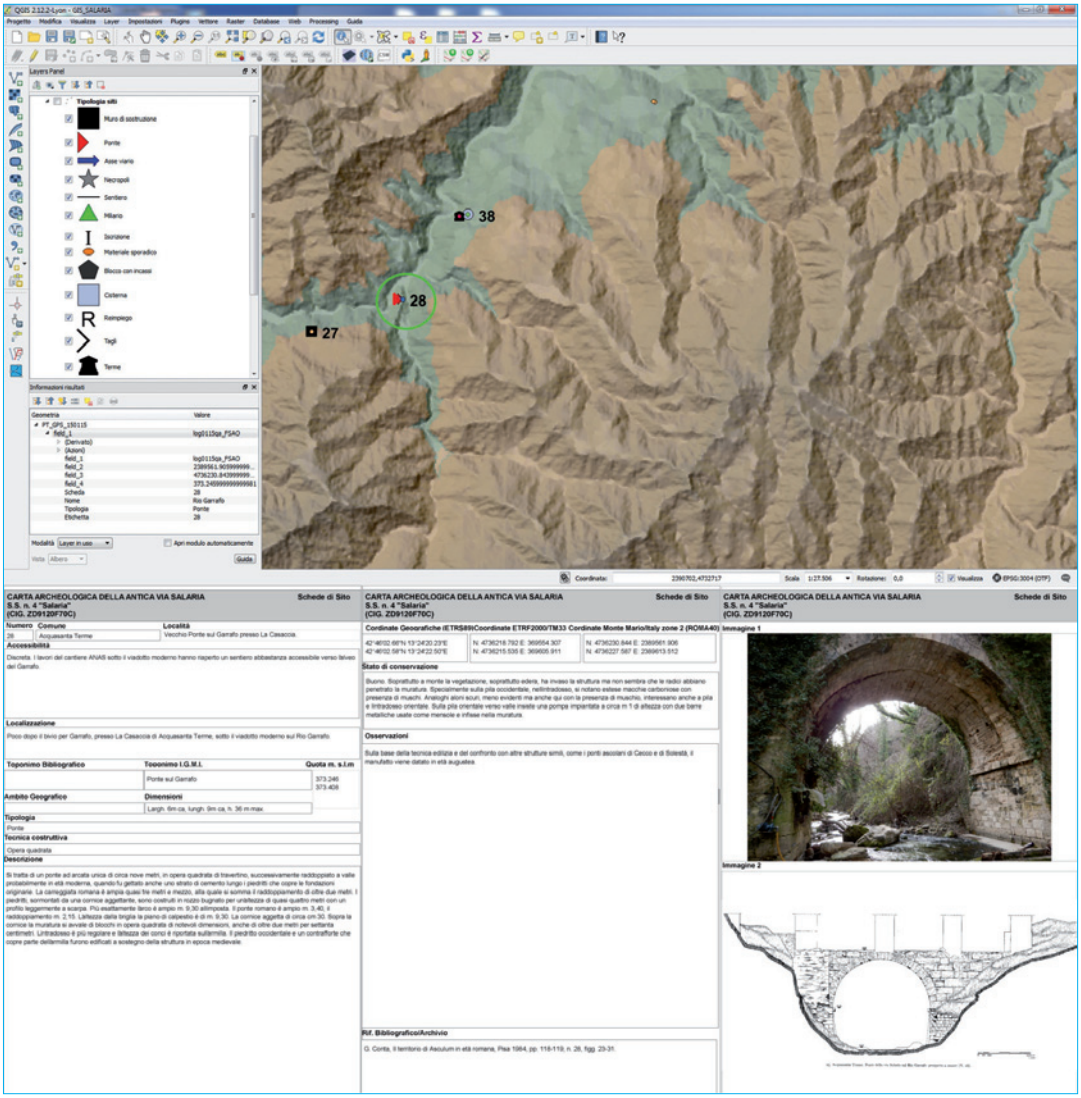


Fig. 2. The cataloging system and the GIS of the Via Salaria (elaboration by M. Silani).

In the case of the Rio Nile, it is a modestly sized bridge made of travertine blocks, with a single arch more than six meters wide and about three meters high and doubled with a structure in tuff going towards the valley. The structure can be found at Km 167 of the SS4 and today is under the bridge of the old state road on one side and the viaduct of the modern highway on the other. Despite its not having traces of boss work or even the same care in its building, this bridge can be considered as being from the same period as the Augustan bridge of the river Garrafo (Giorgi 2014).

During the acquisition phase of the laser scanner survey, 6 positioning points were created, from which besides the relic in question, 10 BN targets were obtained for the scansion align-

CARTA ARCHEOLOGICA DELLA ANTICA VIA SALARIA
S.S. n. 4 "Salaria"
(CIG. ZD9120F70C)

MONOGRAFIE GPS

Comune	Acquasanta Terme	**Nome**	25A	**Data rilievo**	15/01/2015
Località	La Travetta	**File**	log0115p_FSAO		

Accesso/Descrione

Il punto si trova all'estremità ovest del primo dei tagli tra Favalanciata e Quintodecimo, in località La Travetta. I 3 tagli si conservano a monte della SS4 attuale e sono accessibili. Il primo si trova tra i km 156 VI e 156 VII; il secondo tra km 156 VII e 156 VIII; il terzo al km 157. I primi due sono a una quota superiore. Il punto si colloca a circa 1,20 m dal taglio. Il punto si colloca a circa 3,50 m dal ripiano stradale.

Materializzazione

Il punto non è stato materializzato.

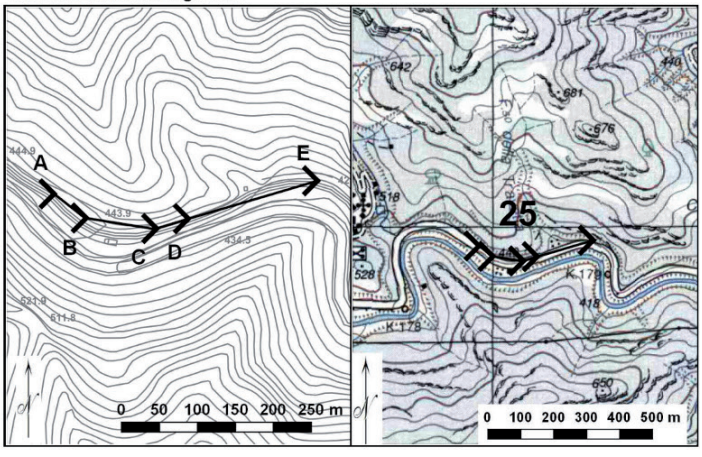
Osservazioni

Coordinate Geografiche ETRS89	**Coordinate Piane ETRF2000/TM33**	**Coordinate Piane Monte Mario/Italy Zone 2 Roma40**
42°45'45.77183"N 13°22'23.50708"E	N: 4735748.387 E: 366891.393	N: 4735760.440 E: 2386898.904

Quota ell. 496.588 **Quota s.l.m.** 449.238 **Riferimenti altimetrici** EGM 2008

Foto inquadramento

Localizzazione cartografica



Esecuzione rilievi ed elaborazione dati:
M. Silani, E. Giorgi
DiSCI - Dipartimento Storia, Culture, Civiltà - Sezione di Archeologia
Università di Bologna

Fig. 3. Monograph of a GPS point (elaboration by M. Silani).

ment. The scans obtained with an average density of 6 mm at 10 m were elaborated during the pre-alignment phase using the recognition of homologous targets, while later the record-

ing of clouds was done with a Cloud-to-Cloud algorithm. The software used was *Faro Scene v. 5.5*. The points were texturized using the internal camera of the laser scanner (*Faro Focus 3D Cam2*). Four of the targets used for alignment were geo-referenced with differential GPS, with the methods previously described. The coordinates of said points were used for the geo-referencing of the cloud of laser scanner points.
The overall cloud obtained was decimated by ½ and exported for subsequent modeling. Then the cloud was cleaned and a DSM (*Digital Surface Model*) was created using the software *Geomagic Design X*, again texturized with the images of the internal camera of the laser scanner (Fig. 4).

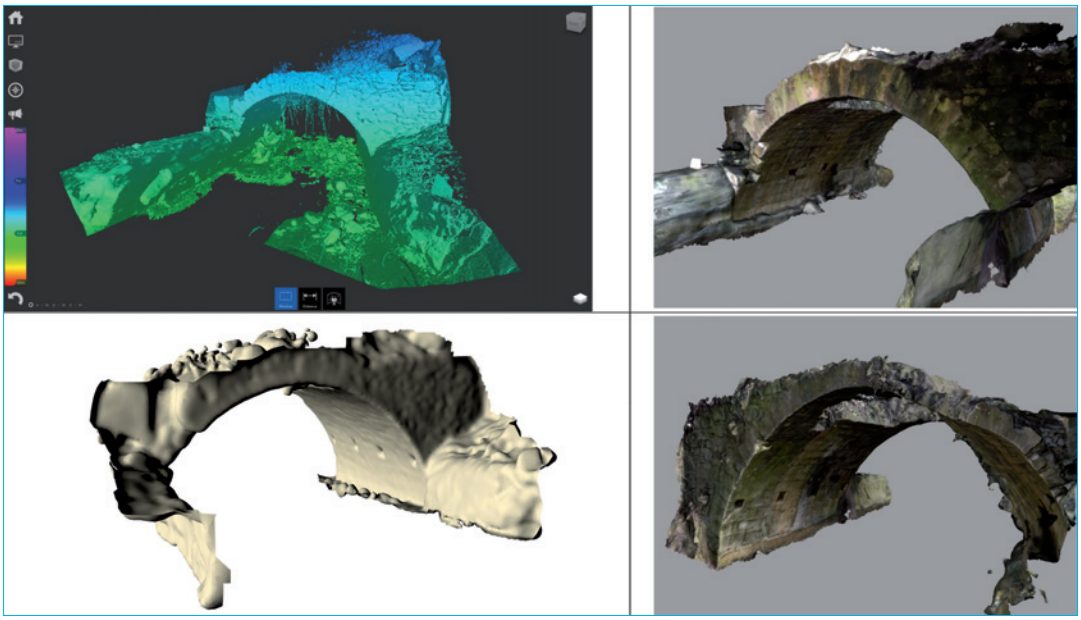


Fig. 4. Laser scanner survey and DSM of the bridge on the Rio Nile (elaboration by M. Silani).

The model obtained can be used for planimetry extraction, examining sections and even structural and building techniques analyses.
With the same procedure, the abutment of the bridge on the river Tronto near Arli was surveyed shortly after the previous one.
This structure uses a strip of tuff along which the river runs. The abutment is set into the tuff bank and is built with a wall of big blocks of tuff, laid out in layers of varying height but overall quite even, with a concrete nucleus. The rocky surface has many cutouts for inserting other elements in part linked to subsequent interventions (Giorgi 2014).
Also here 8 laser scanner scans were done, pre-aligned, and geo-referenced using targets. At the end of the recording in this case the cloud obtained was exported in .pts format and imported into the software *Cloud Compare*. Here the cloud of points was compared to the results obtained during the photogrammetric survey.
In the case of the abutment of Arli, in fact, also an image based photogrammetric survey was done using the software *Agisoft Photoscan*, starting with 78 photograms taken with a compact

digital Nikon AW120 16 megapixel camera. The photogrammetric survey was then geo-referenced on the basis of the same targets used for the laser scanner survey and present in the photograms.
At the end of the comparison of the two clouds of points, a single cloud of the total points was obtained and then reimported into the software *Agisoft Photoscan* to create a mesh model and to do the texturization. Lastly, orthophotos were produced of the prospects of the bridge abutment and also the planimetry, prospects and axonometric projections (Fig. 5).

(M.S.)

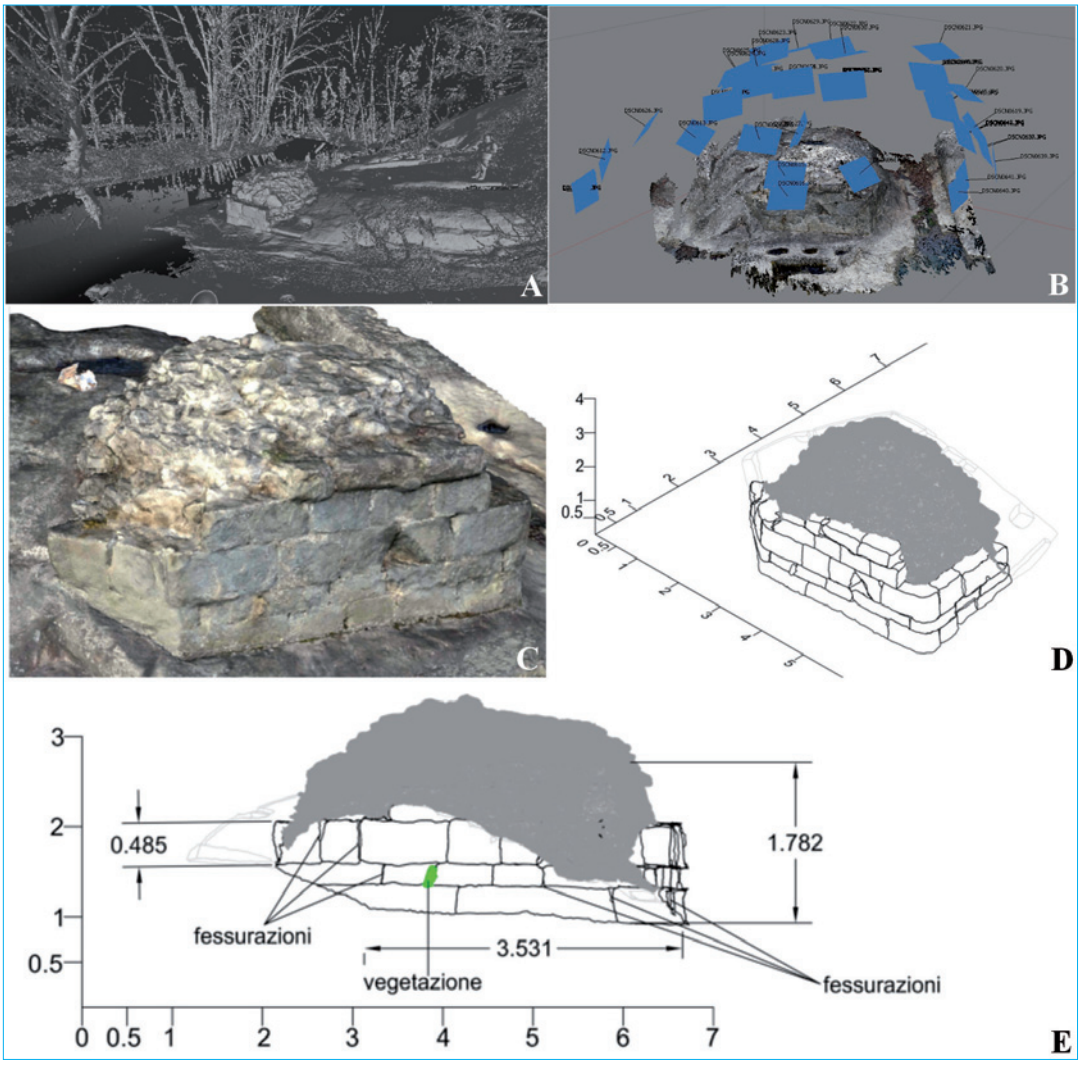


Fig. 5. Abutment of the bridge on the river Tronto near Arli: laser scanner survey (A) and photometry survey (B), polygonal mesh model (C), axonometric projection (D) and prospect (E) (elaboration by M. Silani).

Conclusions

Even if the documentation project and survey of the infrastructures of the Via Salaria is still in its early stages, the results obtained represent an indispensable starting point for subsequent archeological and structural analyses and for the mapping of deterioration that is currently ongoing.
As a final analysis, the geo-referenced 3D models were positioned on the current DTM model created previously by the CTR of the Marche region by way of the interpolation of altimetric and hydrogeological data through the aid of the program ANUDEM. The combining of this model with the geomorphologic analysis for the most important sectors will be done with the aim of recreating a model of the Roman era landscape as well.
These early results, in our opinion, represent the starting point for the historic-archeological study of the ancient Via Salaria as well as a jumping off point for the development of virtual tours and for the promotion of this heritage that favors slow tourism and bike tourism.

(E.G., M.S.)

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Virtual Heritage: Some Experiences of Survey of Archaeological Finds by Low Cost Techniques

Paola Puma

☞ DIDA, Dept. of Architecture, University of Florence, Florence, Italy – paola.puma@unifi.it

✔ KEYWORDS: Virtual heritage, survey of archaeological finds, faliscan finds, Narce, etruscan finds

ABSTRACT

The paper presents the first two outcomes of the "Virtual heritage projects" research program, conducted in 2014-2015 by the group coordinated by the author and born to fulfill a specific scientific project; the aim of the research program was the idea of rethinking in terms of low cost and speed the data acquisition of survey of archaeological finds -when is only aimed at advanced visualization for musealisation- basing the (at that time) emerging technique of photo modeling (Shape From Motion- SFM).

The possibility of "representing the landscapes" of archaeological contexts in an effective and real impact in terms of musealisation, is transmitted by experiences of different types and scales as well in the reconstruction of the original environmental context as in the 3D model display of small objects at a larger scale than the real (Bertocci, Arrighetti, 2015). The use of HD 3D models of archaeological finds has the added value of many advantages linked to the possibility of visual and perceptual contact (and in more advanced cases, also of the interaction) with an unavailable object in time or in place or not accessible for reasons of conservation; this allows a number of advanced features, such as the vision larger scale in respect of real to be able to dwell on details not visible to the eye rather than the virtual restoration (Ippoliti, Meschini, 2011). The modeling of archaeological finds require a realistic representation of the nature morphologic, material and of conservation of artifacts with irregular geometries; photomodeling has introduced a working environment that allows the representation of three-dimensional objects based on global integration of phases of survey (which we have used for shooting with control points for the respect of measurement of the objects), modeling and representation (Remondino, Campana 2014).

The "Falisci in 3D" Project

The first application of research (Fig. 1) was realized in 2014 on the occasion of the exhibition "The Hill people. Faliscan and Capenas finds in the National Archaeological Museum of Florence "(Camilli, Sorge, Zifferero 2014), dedicated to a broad selection of more than 800 finds from the same museum.

The exhibition allowed to retrace many complex dating from the late Bronze Age till the Romanization of the area of *Faliscan* settlements, including the Necropolis of Pizzo Piede, located in Narce (Viterbo-Italy); here was excavated the grave 23 (B), where were found about 40 objects belonging to a woman of the highest social level. The grave goods in the project

Fig. 1. The "Falisci in 3D" Project: the Faliscan territory; the grave goods from the tumb 23 (B); the objects documented; the post processing and the resulting 3D models.

come from a burial consisting of a sarcophagus in a deep pit with a niche adjacent to contain the rich furnishings (Camilli, Cianferoni 2014): the goods personal of the defunct (including princely rank items like an elaborate belt by bronze plating) and the home tools placed with the body (including a censer in bronze plate and a tripod complete of a bigger bowl and three smaller bowls).

The surveys were performed on about 20 pieces, in about 2 months and with mixed results; the outcomes, in fact, that can be considered reliable -both in terms of the compliance of metric characteristics as of the realistically visual features of the materials- may be declared for 15 objects, whose 3D models were displayed in the exhibition dedicated by a video projection of objects in scale from 50:1 to 100:1.

The video projected in the dedicated section of the exhibition is available at the link https://youtu.be/OT7MXqyf2ZM

The "Baratti in 3D" Project

The second case study is referring to finds from the monumental Etruscan Necropolis of San Cerbone, located in the Archaeological Park of Baratti and Populonia, so important in the

landscape of Etruscan funerary archeology (Zifferero 2000). The vast resources that made the Etruscan town of Populonia a very rich city thanks to metalworking emanating both from its territory and from the island of Elba, allowed to the most powerful families around the VII century BC, to build the monumental necropolis that we can see in front of the sea of Baratti, where they have built rich burials of precious objects coming from far away and so impressive as to be known as the "tombs of the princes." In 2015 thus it took place at the Museum of the Territory of Populonia in Piombino the campaign of survey of two grave goods from the Tomba del Bronzetto di Offerente and Fossa della biga (Fig. 2).

Fig. 2. The "Baratti in 3D" Project: the Tuscan territory related to the project: the Archaeological Park of Baratti and Populonia; the two tumbs related to the project: Tomba del Bronzetto di Offerente, Fossa della biga; the post processing and the resulting 3D models.

By calibrating different settings of data acquisition and processing, we reached the quality objectives defined by metrically reliable 3D reconstructions in double graphics output: geometric "not real" output for the appreciation of the dimensions and morphology of the pieces and texturized output for the visual appreciation of their workmanship's value and characteristics of the material. The survey results rated as excellent by the archaeologists, with respect to the limits project time's and budget's, have amounted to 80% of the total 54 pieces documented.

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Integrated Methodologies For The Study, Enhancement and Sharing of Archaeological Heritage: The Archeofano Project

Paolo Clini[a], Maria Gloria Cerquetti[b], Laura Bertuccioli[c], Laura Invernizzi[c], Massimo Gasparini[c]

[a] DICEA, Dept. of Civil and Building Engineering and Architecture, Polytechnic University of Marche, Ancona, Italy
[b] Government Department for Archaeology, Marche, Ancona, Italy
[c] Centro Studi Vitruviani, Fano, Italy

The modern town of Fano occupies the site of the ancient *Iulia Fanestris* settlement, the outlet point to the Adriatic Sea and the turning point towards *Ariminum* on the ancient Roman road Via *Flaminia*. The numerous pieces of archaeological evidence, in many cases incorporated into subsequent structures and not usable, have already been the subject of many, mostly isolated, studies which have greatly stimulated knowledge of the city's archaeological heritage, but through which it was not possible, however, to reach a comprehensive understanding and certain understanding of the urban structure of the Roman city. The lack of a unified system of arrangement and organisation of the city's archaeological heritage, the difficulties accessing various archaeological sites, and the lack of detailed studies on some of these sites, are certainly some of the main issues faced in interpreting the uncertainties of Roman town planning. In an effort to respond to this situation and promote the archaeological progress of the investigation and enhance the existing known areas the research project "ArcheoFano" was launched in 2014, with a focus on "Updating, redefining and consolidating the archaeological diagram of the city of Fano in the shared database".

The project is structured according to the different stages of research regarding the collection, data organisation and enhancement of the archaeological heritage.

Following the preliminary collection of archival and library materials related to the ancient *Fanum Fortunae*, a survey of the entire urban layout of the Roman city was carried out, with a primary objective of listing and georeferencing all functional levels found and preserved within the fabric of the modern city. In conjunction with the surveying work, a three-dimensional survey of the intramural archaeological complexes which are difficult to access by the public and which presented the greatest shortage of graphic documentation was carried out.

The subsequent joint development of point clouds obtained by laser scanner and topographic survey allowed for the realisation of various two-dimensional outputs: using appropriate reference planes, orthophotos and slices were generated for the vectorisation of standards developed. Additionally, navigation interfaces have been carried out of all archaeological sites discovered, using the Leica TrueView System.

A geophysical prospecting campaign using GPR (GPR – Ground Penetrating Radar) was planned in a manner to be performed in open spaces free of buildings (such as car parks, cloisters and gardens) in the area probably occupied by the ancient forum complex in the city of *Fanum Fortunae*, to detect information on the exact location of the forum and thus facili-

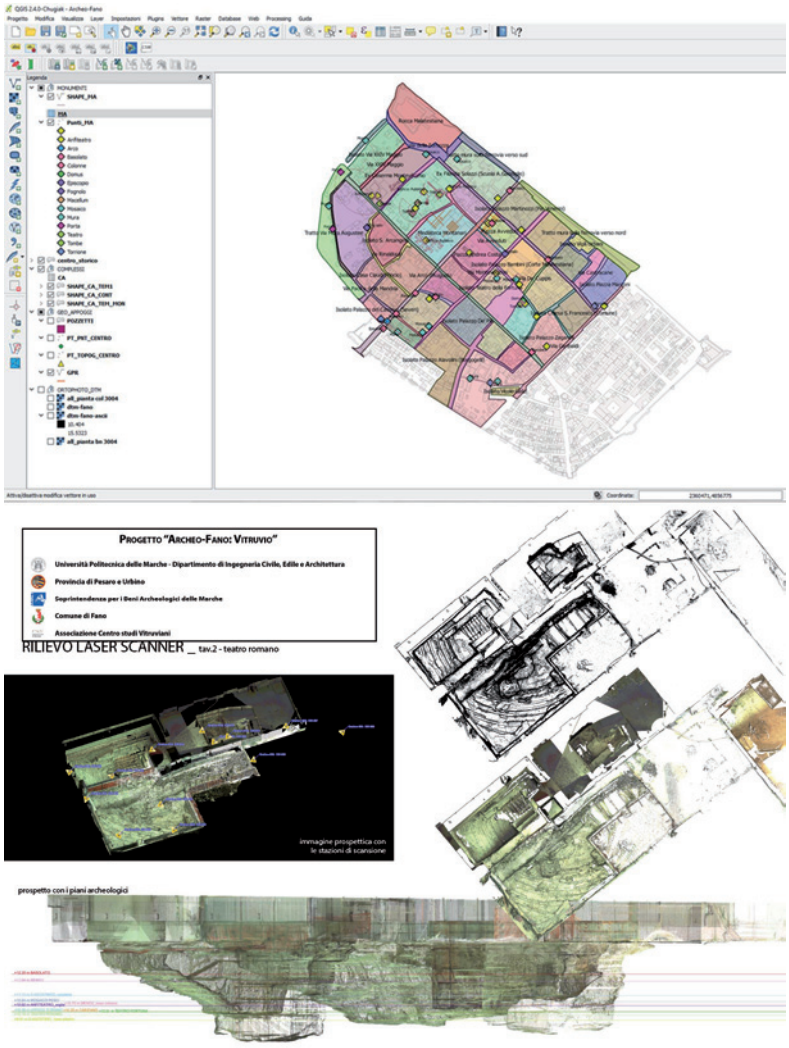

Fig. 1. From top to down: view of the archaeological geodatabase of the ancient Iulia Fanestris settlement; orthoimage, slice and screenshot of the navigation interfaces of the roman theatre.

tate, in case of positive results, the planning of precise excavations in easily accessible areas. Information obtained showed the presence of interesting anomalies, characterised by similar dimensions to those of the functional Roman levels closest to the point of detection.

In parallel to the steps described so far, in order to allow for systematic organisation of the information collected, the construction of a relational database model was also initiated, aimed at creating a geodatabase in a QuantumGIS open source environment.

Moreover, the Department of Civil and Building Engineering and Architecture of Polytechnic University of Marche is in charge of the development two strands of research, still in an evolutionary stage, relating to the creation of a series of augmented reality applications and

the creation of a virtual visit to the archaeological museum of Fano. The ArcheoFano Project allowed for the first time a structured systematisation of all the archaeological data relating to the urban centre of Fano, with particular reference to the central areas investigated. The georeferencing of all present and new data has allowed for the construction of a metrically defined urban model that lends itself as a basic tool for the development of new studies, reviews and advancement of knowledge about the individual sites and the general urban model. A scientific method of data integration and return has also been identified and established, achieving complete results for the investigated areas, but also establishes as a container that will be able to implement detailed studies of all other areas of the historic centre not currently included in the surveys.

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Digital Mapping For Archaeological Heritage

Raffaele Catuogno, Antonella di Luggo*

☞ *DiARC Dipartimento di Architettura – Università degli Studi di Napoli Federico II, Naples, Italy.

✔ KEYWORDS: Archaeological heritage, range-based survey, image-based survey, digital mapping, Phlegraean Fields, archive catalogues

ABSTRACT

This essay intends to show the results of a research about Phlegraean Fields, a large zone which extends to the west of the city of Naples, very important from an historical, archaeological and landscape point of view. Surveying and representation methods have been experimented which can read and effectively represent the complexity of areas characterized by the presence of archaeological sites. A the same time, the potential of the techniques of interactive representation including immersive shoots have been verified, with the goal of identifying new methods of spreading knowledge to enhance cultural assets.

1. The Phlegraean Fields

The area of *Phlegraean Fields* covers a large zone which extends to the west of the city of Naples, which has been characterized since antiquity by an intense volcanic activity.

Fig. 1. Francesco Vega, Map of the Gulf of Pozzuoli with part of the Phlegrean Fields, 1770-1780, The National Library "Vittorio Emanuele III", Naples

Fig. 2. Phlegraean Fields, mapping of the archaeological sites of the whole area

Alongside the interest in its geological history, the area of *Phlegraean Fields* is particularly significant for the large number of testimonies of the history of ancient civilizations who settled there, first among all Cuma, the oldest colony of Magna Graecia, around which an urban-territorial system of great importance developed, that included the port and the commercial city of Puteoli, the military ports of Lucrino and Capo Miseno, the system of imperial villas and Thermal baths of Baia. To this day, an immense archaeological heritage has been preserved, distributed throughout the territory, which gives evidence of the richness of the civilizations that inhabited it and of the intense urbanization in past ages. This, together with the environmental and landscape aspects, gives form to a heritage which is unique in the world, an archaeological open-air museum that must be enhanced by cultural promotion founded on a project of knowledge. The numerous archaeological remains distributed throughout the territory witness a prosperous past and the presence of rich civilizations, with their temples, public buildings, markets, villas, spas, amphitheatres, and numerous other buildings, since they were not only seats of important military centres and naval bases, but also areas for pleasure, as it has been handed down to us through many writings dating to the Roman era.

All the archaeological sites of this area were mapped and catalogued, thanks to direct surveys, archive researches and consultation of previous studies. Each artefact was linked to data about its typology, its state of conservation and its accessibility, thus creating a database and a system of online cataloguing which can be entered by a web site, both for consulting and for

input of data. In addition to the most significant archaeological sites, this research included the study and the analysis of minor archaeological remains, some of which were brought to light through recent excavation campaigns.

2. Cataloguing archaeological remains

All activities began by formalizing working relationships with the bodies in charge of protecting archaeological assets who operate on the territory, in particular with the offices of Cuma, Baia and Pozzuoli of the Superintendence for Archaeological Heritage of Naples, defining specific agreements to study the area as a whole, and later identifying which artefacts to survey, depending on the need for specific detailed studies of the metric and constructive aspects.
In a first phase, the work of the research group focused on identifying the archaeological remains present on the territory, using direct onsite inspections, searching archives and consulting past studies. Of fundamental importance was to compare the work with the documentation stored at the archives of the Superintendence for Archaeological Heritage which allowed to define an abacus structured on specific entries, in order to identify the recurrences present on the territory. A specific symbol was identified for each entry, to make the connotation and localization of the single artefact readily visible and comprehensible within a larger map where the single presences have been progressively shown.

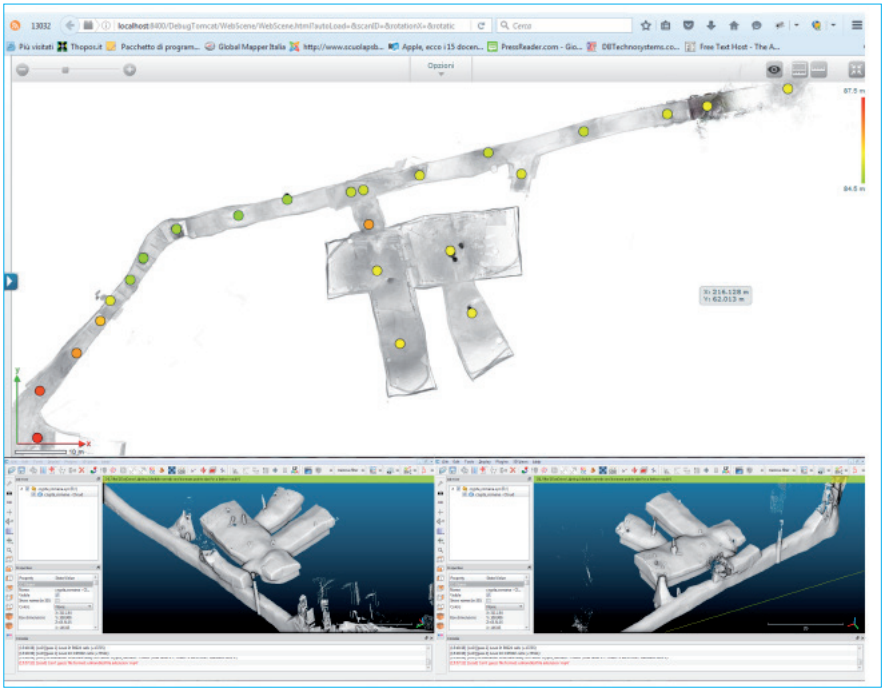

Fig. 3. Cuma, Phlegraean Fields. Roman crypt, visualization and processing achieved by using, respectively, Webshare and Cloudcompare software tools

A different colour was established to indicate the specific condition in which the artefacts are found and specifically: above ground, earthed, submerged, not identified (where they were present in the archive catalogues, but not found within the context of the inspections), not catalogued (where they were identified on site, but not present in the archive catalogues). The accurate identification was associated to other symbols, relating to construction, to state of preservation and accessibility, differentiating the location into: full accessibility, public property or private property.
Starting from such preliminary analyses, this research became more thorough by surveying some archaeological sites of special interest, properly identified according to their specificity and location, and for which the documentation provided by the bodies responsible for their preservation was incomplete or even absent.

3. Range-based and image-based surveying

Direct and instrumental survey procedures have been used with specific reference to the technologies with active and passive optical sensors, through a pipeline of the process during the phases of data acquisition and post-processing, by controlling techniques, methods and outputs.
Some criteria were identified to detect the tools to be used to evaluate the dimensions, the smallest detail, the lighting of the object to be examined and also the range of the different devices. The laser scanning data allowed to have dimensional values, to generate ortho-photos,

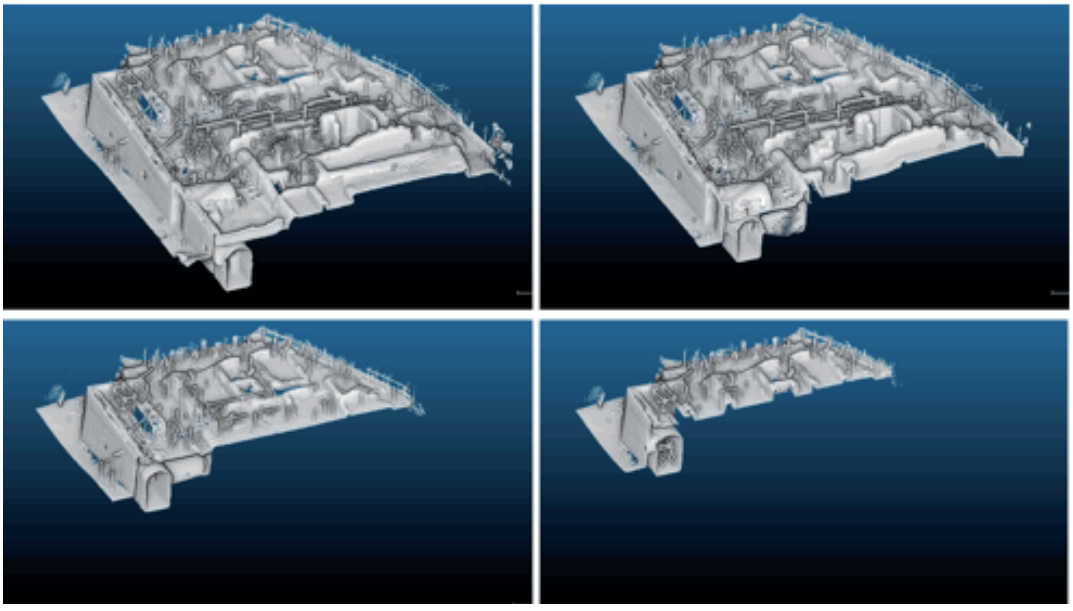

Fig. 4. Cuma, Phlegraean Fields. Roman villa, point cloud in CloudCompare

to elaborate three-dimensional models, to extract textures and to produce spherical photos. Spatial data and colour information allowed to analyse parts and elements of each sample, the quality of surfaces and materials of archaeological remains, thus giving further details.
The research was carried out by a group of researchers of the Architecture Department and the Interdepartment Centre of Urban Eco Research of Naples University Federico II which for many years has been focusing on the study and documentation about architectural and archaeological heritage in Campania.
The study of *Phlegraean Fields* area included the survey of a Roman villa discovered near the Lake of Averno, located in a particularly significant position from the landscape point of view. Time returned a great part of its structure, except a portion collapsed in the underlying slope, and still today the hill on which it is located offers a wonderful view on what, in Roman age, was the ancient port and which changed into a lake after the eruption of Monte Nuovo.
This survey was performed in February 2013 under the supervision of Superintendence for Archaeological Heritage of Campania, by using a modulation laser scanner of CAM2 Focus3D phase which allowed to execute 50 scans for the survey of the above ground parts and of the underlying cisterns.
Since they were performed shortly after the end of the excavation of this artefact and before some safety works of structures, the metric investigations served as a documentary evidence of the conditions of these places at the time of their discovery. In this sense, laser scanning was particulary suitable for producing a virtual cast of this villa, immediately allowing the necessary restoration and conservation works.
The results of this work and the comparison with similar exemplifications in the territory enabled to make assumptions about the artefact reconstruction. Furthermore the laser scanner allowed the three-dimensional reconstruction of underground spaces thanks to the reflectance values stored in the point clouds.
The same technology was used for the survey of Cuma Roman Crypt, a tunnel escavated in the tuff at the base of the Monte di Cuma with a west-east orientation and composed by four variously inclined straight sections, whose unusual profile was influenced by the presence of some spaces already existing at the time of its construction and by the need to create a direct connection between Cuma forum and the Portus Iulius.
The laser scanning was a particularly appropriate technology, considering the strong irregularity of the location which shows significant dimensional and morphological variations and does not allow any discretization according to recurring elements or recognizable geometries.
This route also showed remains of ancient places and two great cisterns of Roman time, as well as ruins of a cave basilica and early Christian tumbs. It was possible to identify and register some skylights which effectively illuminate the space along the way and the areas of collapses taking places over the centuries.
For the survey of the Roman Crypt 36 scans were performed by using as a reference spherical and chessboard targets. Speed and pace of rotations have been previously set up by determining scanning resolution, that is the density of the grid of points observed at a certain distance and the quality of acquired data, typically higher for slower rotations. Therefore these

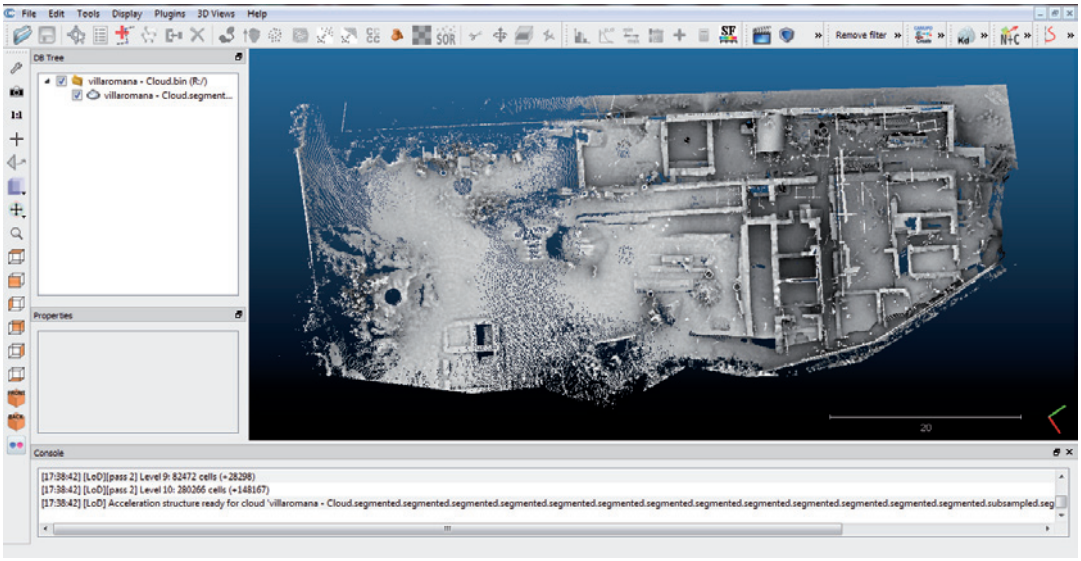

Fig. 5. Cuma, Phlegraean Fields. Roman villa, processing in CloudCompare

two parameters also determined the duration of each single scan as equal to 7 minutes. During acquisition this instrument archived the distance and the horizontal and vertical angles of each point, also obtaining the reflectance of the surface hit by laser.
Scans have been subsequently registered in a single point cloud giving the real conformation of the space, allowing the complete digital reconstruction of this location and producing a new documentation of the condition of these places.
Since these are archaeological studies, particular care has been taken to representation phase, by giving the building materials of surveyed spaces to different scales, focusing on the copy of all the tracks on surfaces.
Similarly, laser scanning was used for surveying two cisterns of Roman era located within the municipality of Bacoli between the Aragonese Castle and the port of Miseno, whose reading is strongly compromised by the presence of recent structures and whose remains have been overwhelmed over time by other buildings which have upset their original arrangement.
This survey was performed through 30 laser scans providing data of the whole artefact, whose processing allowed the representation of a 3D model able to illustrate the different periods of building and the virtual reconstruction of the original configuration.
In addition to these experiences, this research also deals with the study of other archaeological sites in Phlegrean area such as the Temple of Venus and the Temple of Diana in the archaeological park of Baia, the Cuma Acropolis, the ancient lighthouse of Capo Miseno, the infrastructures of port of Bacoli and many other significant artefacts such as the Arco Felice Vecchio, the monumental door which was the entry to Cuma, built in the I century A.C. to enable the passage of the via Domitiana through the monte Grillo.
For the survey of the Arco Felice Vecchio and considering the artefact dimension, the presence of a dense vegetation and the difficult terrain of these places, a careful survey project

was necessary to identify were targets had to be located. At present the Arco has a high arch having on its top remains of other structures whose original form is documented in the drawings of the great travellers of the eighteenth century. In fact the *Phlegraean Fields* were one of the most important stages of the Grand Tour, because this territory offers singular attractions from the scientific and historical point of view and allows to see impressive natural phenomena caused by volcanic activity and, at the same time, to closely study important archaeological sites by documenting them through particularly interesting representations.

4. Mapping digital data

Acquired data were entered in an on-line system for remote use. In this respect, this work illustrates how to manage the Webshare application by Faro, conFig.d after the Tomcat installation by Apache, to enable data visualisation and virtual use of the detected space, by describing the ways of archiving the different scans and the methods for on-line access. This application allows to virtually investigate and visit surveyed areas, usable through panoramic views and overview maps. These products not only can be subject to verification and control procedures but also to measurements, thus obtaining an archive of information useful for

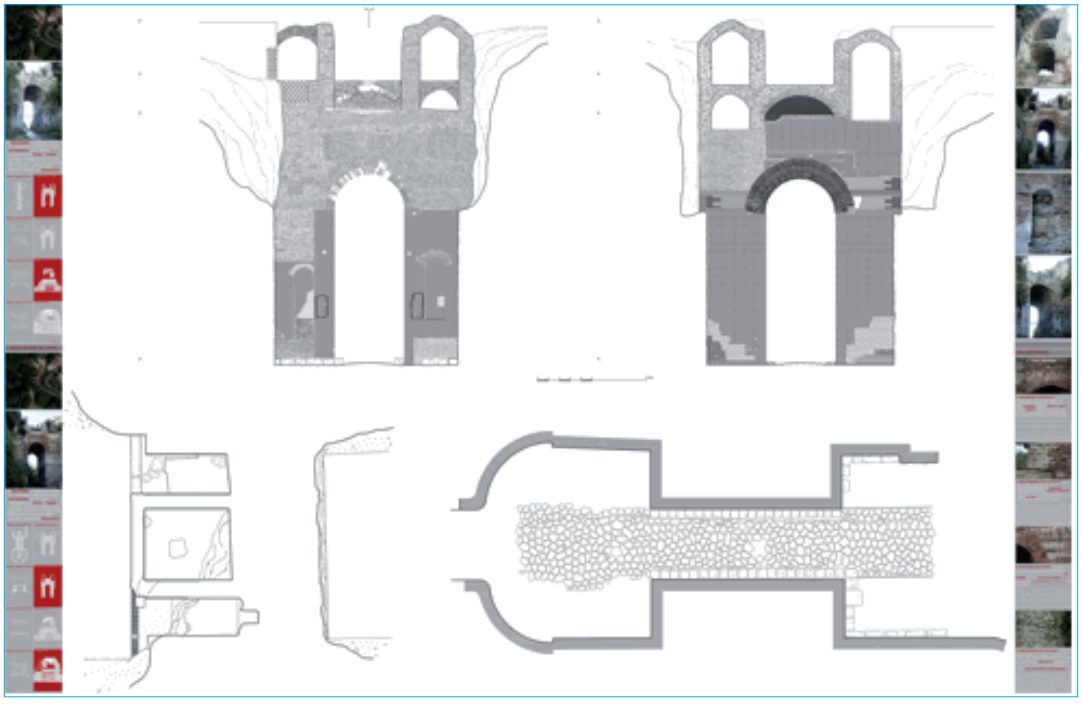

Fig. 6. Cuma, Arco Felice Vecchio, plan and sections. Drawing s by Marcella Contiello. Thesis in Architectural survey: Nuove metodologie per il rilievo del patrimonio archeologico: l'Arco Felice Vecchio a Pozzuoli. Supervisors: Prof. Arch. R. Catuogno, Prof. Arch. A. di Luggo.

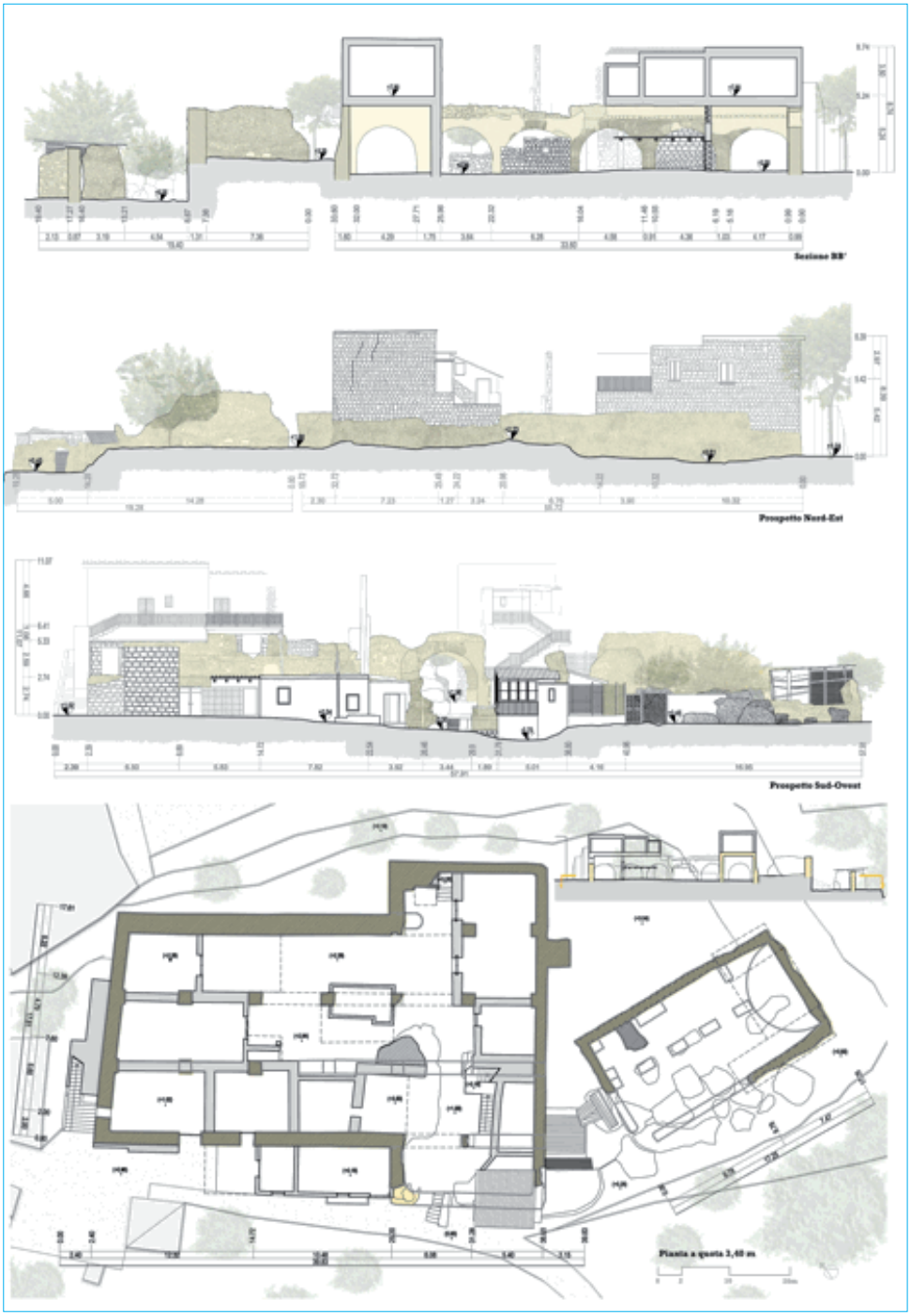

Fig. 7. Bacoli, Phlegraean Fields. Trippitello cisterns, plan and sections. Drawing s by Jacopo Munzù. Thesis in Architectural survey: Traces and signs of the past in the Phlegraean Fields. Laser scanner survey of Trippitello cisterns. Supervisors: Prof. Arch. A. Luggo, Prof. Arch. R. Catuogno.

further investigations. effectiveness of panoramic views have been verified, by testing new methods for visualising and using collected data, able to effectively render the complexity of archaeological sites.
Therefore an interactive map (*Matchmed*) was created to give information at different levels, opening the way to new readings of these places, even through the comparison and the compared data reading.

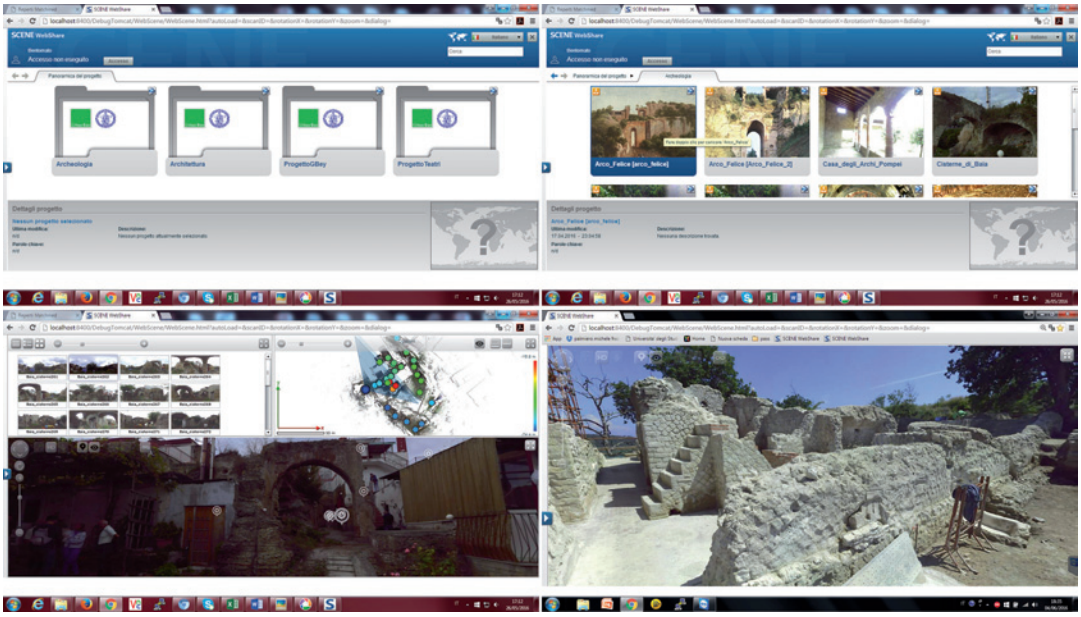

Fig. 8. WebShare screenshots about Trippitello cisterns (Bacoli) and Roman villa (Cuma)

The interactive map *Matchmed* is based on the computerized cataloguing of the surveyed sites, and data have been entered according to a previous recognition. This cataloguing uses specific symbols able to find the characteristics identifying each site. A sheet including identification data, geographic coordinates, photographic documentation and a short description was prepared for each site.
This system is based on the *Wordpress* platform (*CMS* open source), conveniently extended to implement the functional specifications. This platform allowed to create a *CRUD* (*Create, Read, Update, Delete*) and the modular nature of *Wordpress* enabled to develop specific plugin to manage the geolocation of finds, the export of information in Excel format and the presentation of multimedia content.
The *Matchmed* platform allows to browse within the study and to perform queries according to specific typologies of information such as pictures, videos and graphics, as well as according to tags such as state of conservation and accessibility.
It should be noted that not only this system allows to access previously entered information, but it is also open to further contributions, with different levels of accessibility, since it is a web-container site and an updatable over time database, with the possibility to enter ad-

ditional data progressively through specific sheets. It is possible to request a visualization on map of any kind of find and to obtain both geographic and graphic data for each find.
A further implementation is expected which allows an interaction with apps for mobile devices both for using and for entering data to be sent to server according to input, consultation and research formats.

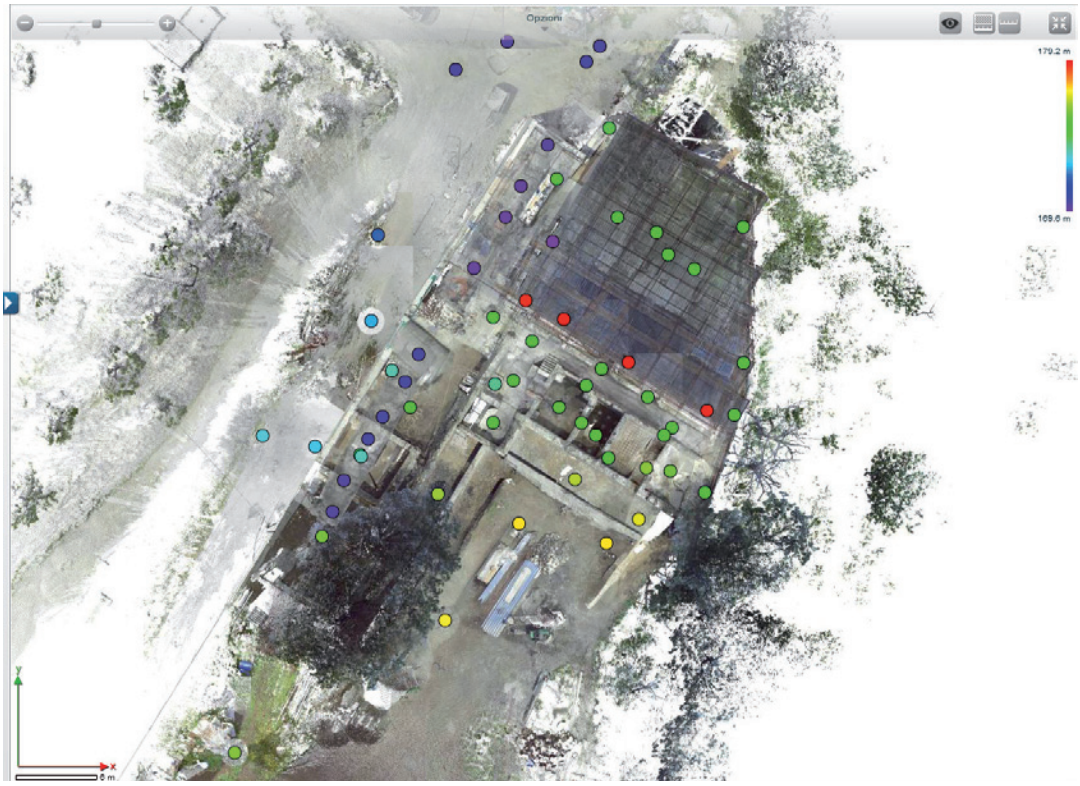

Fig. 9. WebShare screenshots about Roman villa (Cuma)

5. Conclusions

Spreading knowledge in Internet and introducing new methods of use of the archaeological assets can trigger an implicit process of growth and territorial promotion.
However, these actions must avail of the cross promotion of ideas between sectors, companies and individuals, starting with a creative action which requires tangible interaction between the players who work on the ground, to give life to a continuous process of construction of new knowledge. In this sense, it is appropriate to combine innovation based on the conscious use of new technologies with the history of the places, focusing on a renewed method of "creating" culture and on the awareness of the value of the cultural asset as a unifying element and catalyst, able to trigger a virtuous circle of territorial development. What is necessary is a renewed way of becoming acquainted with the archaeological heritage of Phlegraean Fields and

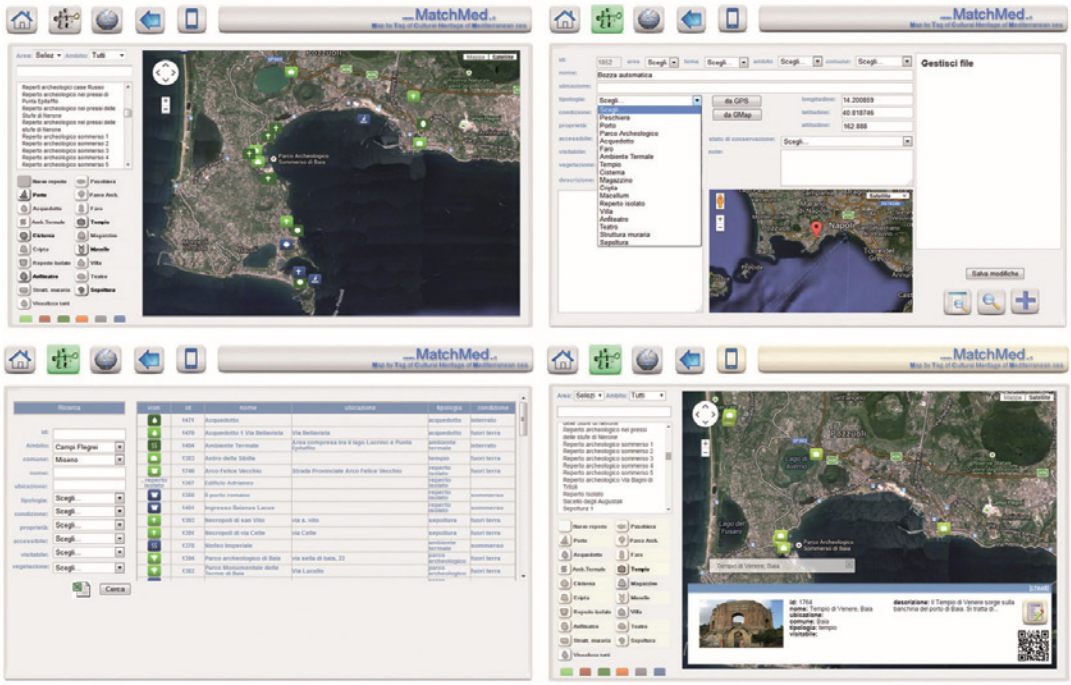

Fig. 10. Matchmed screenshots, mapping archaeological heritage in Phlegraean Fields

this is possible starting with its knowledge and spread in Internet, promoting an action which is aimed at identifying in it the strategic axis of a model of development. Culture has indeed an essential role to play since it is the depository of tacit knowledge, of the conventions and of the behavioural models which lie at the basis of what identifies a territory and can therefore generate richness and employment, with positive effects on the entire local community.

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A Landscape Baroque Reutilization of Two Roman Buildings on *Colli Tuscolani*: Surveys, Confirmations and Updates

Saverio D'Auria*, Rodolfo Maria Strollo

☞ Laboratory of Survey and Architecture – LAREA
Engineering Macroarea
University of Rome 'Tor Vergata'
saverio.d.auria@uniroma2.it, strollo@ing.uniroma2.it

The *Casino Altemps* – the first unit of extended complex called *Villa Mondragone* – was built in *Tuscolano* in the last quarter of the sixteenth century by Martino Longhi il Vecchio for the cardinal Marco Sitico. The factory was partially founded on the ruins of an ancient Roman Villa dating back to the first century A.D., attributed in the eighteenth century to the consuls Quintili: the walls, however, didn't coincide with the existing structures because it was preferred to rotate this new building unit, in order to define a precise axiality with the diagonal of the rests of another wide *basis villae* (with an almost square plan), situated about seven hundred meters downstream, on the same hilly slope.
This magnificent arrangement was accentuated, at the beginning of seventeenth century, by bourgeois improvements entrusted to Flemish architect Jan van Santen, called Vasanzio. Later, a majestic boulevard planted with cypresses, still existing, emphasized, at landscape and urban level, the union between ancient and new buildings.
Repeated archeological excavations made at *Villa Mondragone* during last centuries, on several occasions and chronologically far away from each other, brought to light many old walls that, however, have never been completely revealed in the perspective of a global analysis.
The surveys recently started on archeological ruins emerged in the recent past and made using laser scanner technology, confirm the hypothesis formulated by Jesuit archaeologist Felice Grossi Gondi at the beginning of the twentieth century, related to the choices about the ancient planning; furthermore, they allow to upgrade the existing planimetries, giving more information for a clearer knowledge of the monument.

Historical introduction

Many of late-Renaissance *Casini* built on the hills of *Vulcano Laziale*, in the south of Rome, which contributed to the definition of the so-called *Ville Tuscolane*'s complex, were founded on the ruins of Roman buildings with similar functions, even if dimensionally more extended. It is known that, in this area, respected personalities and influential families had a *tusculanus secessus*. Between them, Cicerone, Galba, Lucullo and Tiberio stood out.
Some factories of sixteenth century, although smaller than the ancient ones, traced the walls of pre-existing ruins, optimizing the use of what was still solid and structurally reliable. How-

ever, in other cases, didn't happen the same thing, because it was only endorsed the exploitation of the site, ignoring the tracing of original planimetric orientation (Fig. 1).

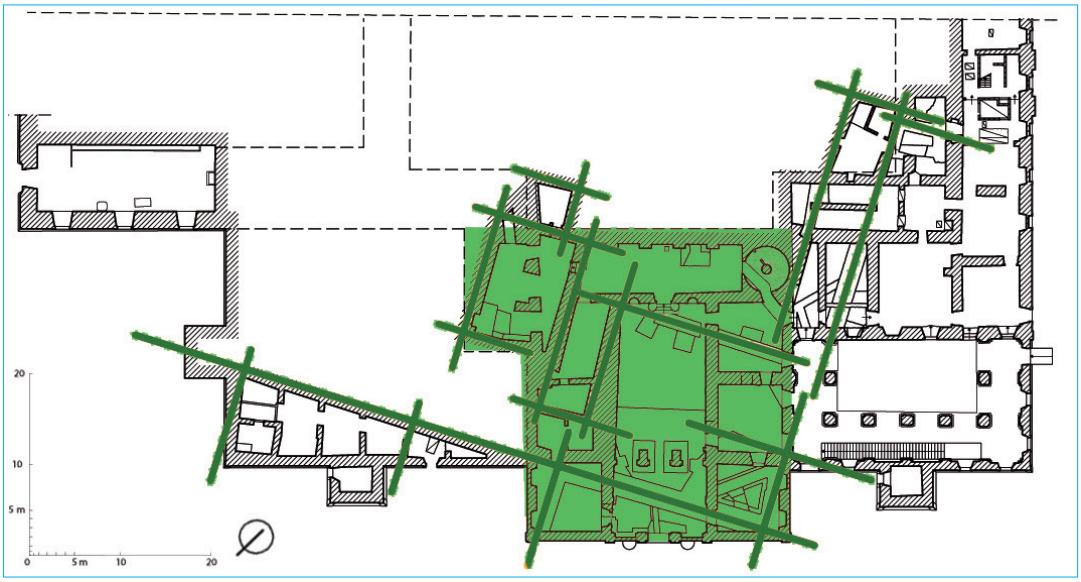

Fig. 1. A part of the basement plan of *Villa Mondragone*. Walls of an ancient Roman residence of the first century A.D. (stroked) and shape of the first sixteenth century structure (hatched) are highlighted in color.

During the next phase of enlargement of the villas, which took place between the end of sixteenth century and the first decades of seventeenth century, the economic power of the owners brings to the definition of high-impact compositions at landscape level, generally enlarging the axialities established during the previous phase, in accordance with Baroque trends of the time. The *Complex* acquired the aspect that gave to it its greatest notoriety, also sealed by lots of landscapes and engravings.
This structure can be observed, for example, at the bottom of *Villa Aldobrandini* (an artifact also belonging to *Ville Tuscolane*'s complex) where, at planking level of the terracing before the factory, recently emerged (2007) a long section of a wall measuring about 55 meters in a polygonal structure that orthogonally intersect with other two segments (one of which is about 7 meters) both dated back to Republican Age and that probably were residential or cultural structures.

The Roman ruins in Villa Mondragone

The misalignment of the walls of *Villa Mondragone* compared to the ones of underlying ruins – undoubtedly attributed to a residence of late Republican Age – seems clearer and more recurring here than in *Villa Aldobrandini*; furthermore, the landscape "sign" originated from it appears more trenchant. In the case of *Mondragone*, in fact, the financial mean of the founder,

the cardinal Marco Sitico Altemps, allowed Martino Longhi il Vecchio the almost exclusive exploitation of panoramic characteristics of the site where also rose up the residential Roman ruins, later attributed to *Quintili's Villa*, drafting the initial structure of a building intended to acquire the value of a marked territorial sign.
As Grossi Gondi, renowned Villa's researcher, said: «Perhaps, the architect [Martino Longhi il Vecchio], in order to relate the little building of *Villa Tuscolana* made by Vignola and the new factory, deviated from the original lines of Roman edifice».
The *Casino Altemps* was, then, orientated along an axis that, besides correlating it with the previous residence of the cardinal (*Villa Tuscolana*), coincided with the extension of the diagonal of another Roman building situated nearby, having an almost square contour (probable terracing of another big Villa dating back to the first century B.C.). This wide and flat surface, according to what Grossi Gondi says, was fenced in with high walls by Altemps' will, mainly exalting, in this way, its almost regular four-sided form (220x250 meters circa); the land was, then, intended to be a *pomario* and later, in seventeenth century, a "barco" of livestock, acquiring the name of *Barco* that still identified it. Its spaces, nearly all hypogeum, were matters of concern to many archaeologists, most notably Thomas Ashby, who made the first representation of them (Fig. 2). The abstract joining axis between new *Altemps' Casino* and cardinal's old residence, close to one of the vertex of that wide four-sided corral built on others Roman remains, was concretely converted in a long boulevard, situated along the ridge that works

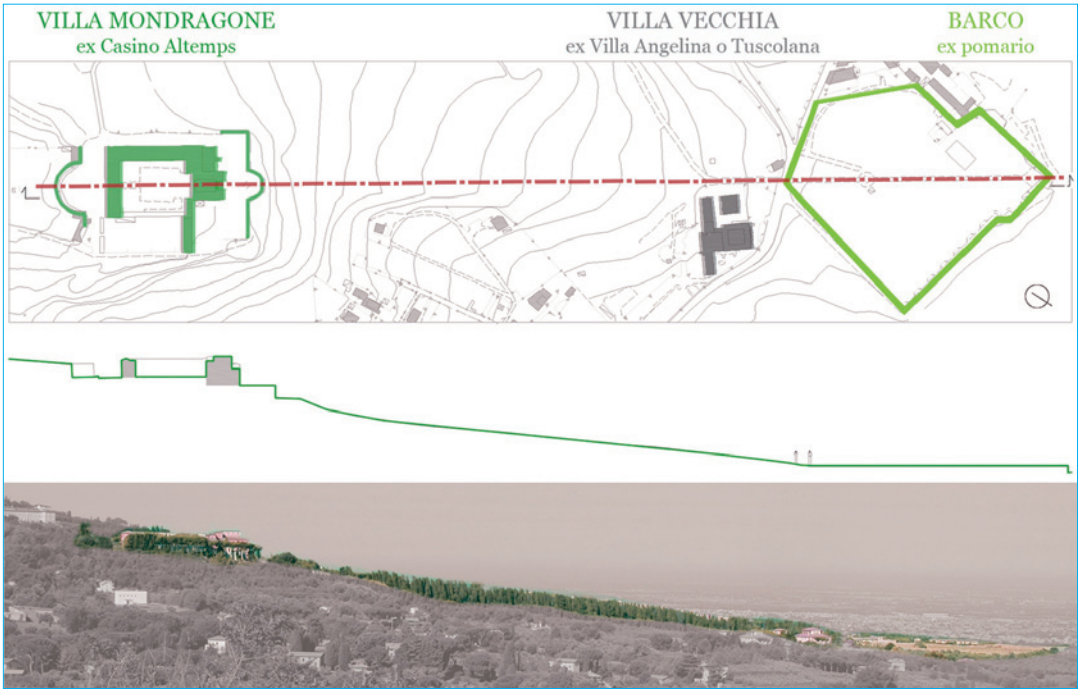

Fig. 2. From top: abstract alignment axis between Villa Mondragone and Barco; territorial section along the axis; picture of the complex

as a divide between these two sides which converge in it. After the intervention promoted by Borgheses and entrusted to Vasanzio in sixteenth century, the general disposition of the structure acquired a more marked and recognizable aspect thanks to the addition of many elements situated in relation to the axis, mostly following a diagram of symmetry, both as additional buildings and as supplied elements: the extending wings of *Casino*, internal courtyard of *Piazzale Maggiore*, the *Terrazzone* – majestic artificial pedestal situated downstream – with its balustrade characterized by: symmetric arms and central semicircle, two fountains placed opposite the axis, two pairs of high pinnacles and, also, the great exedra of containment of the land upstream. With these transformations, the extension of the axis was increased southward reaching a real length (from the further point of southern exedra to the more external one of *Barco* diagonal in the north) of approximately one thousand meters. The axis was, then, highlighted by the planting, along the boulevard running the ridge, of a double row of cypresses, centuries-old nowadays. These ones still characterize the site strongly, representing a notable urban-territorial sign that, in time, has aroused the interest of artists and novelists.

The surveys

The rotated disposition of the ruins of *Quintilis' Villa*, was already evident in the basement of modern structure of *Villa Mondragone*; Grossi Gondi, in late nineteen century, found further confirmations thanks to the excavations made in *Piazzale Maggiore* (later closed) that brought out other fragments of the ancient construction, documented by himself in different phases. The transfer of ownership of *Villa Mondragone* to the University of Rome 'Tor Vergata' in the early 80s, allowed archaeological superintendence for Lazio, on the occasion of the works of restoration already started, to do ample excavations in many spaces of the factory, revealing other shreds of the ancient masonries (Fig. 3).
These researches confirmed geometric and morphological characters of Roman walls at basement level, underlying the floor of *Terrazzone*. This "new" situation, recently discovered and still visible due to the stop of works, was partially documented by the superintendence itself. Some of the remains emerged during internal excavations of *Villa*, made at the level of *Piazzale Maggiore*, have recently been valorized (2005) introducing in new pavements of the room, situated in south-east corner of *Casino*, a glazed frame, that has made visible a building section with a fragment of crossed-mosaic pavements. At the same level, furthermore, there are other ruins that have remained in the same state of neglect of the downstairs ones for about thirty years: for example, building fragments placed under the planking level of seventeenth century eastern wing of *Villa* – the one added by Vasanzio in order to close in the northeast the great courtyard of *Piazzale Maggiore* – connecting it with new and majestic portico of *Giardino della Girandola*. This situation has been documented for the first time by laser scanning survey.
The tool employed for the survey has been Faro Focus X 330 that, in order to ensure a correct and complete acquisition of the surfaces, has been positioned in seven change points, two of them situated opposite the pass openings between the analyzed space and Vasanzio's portico on

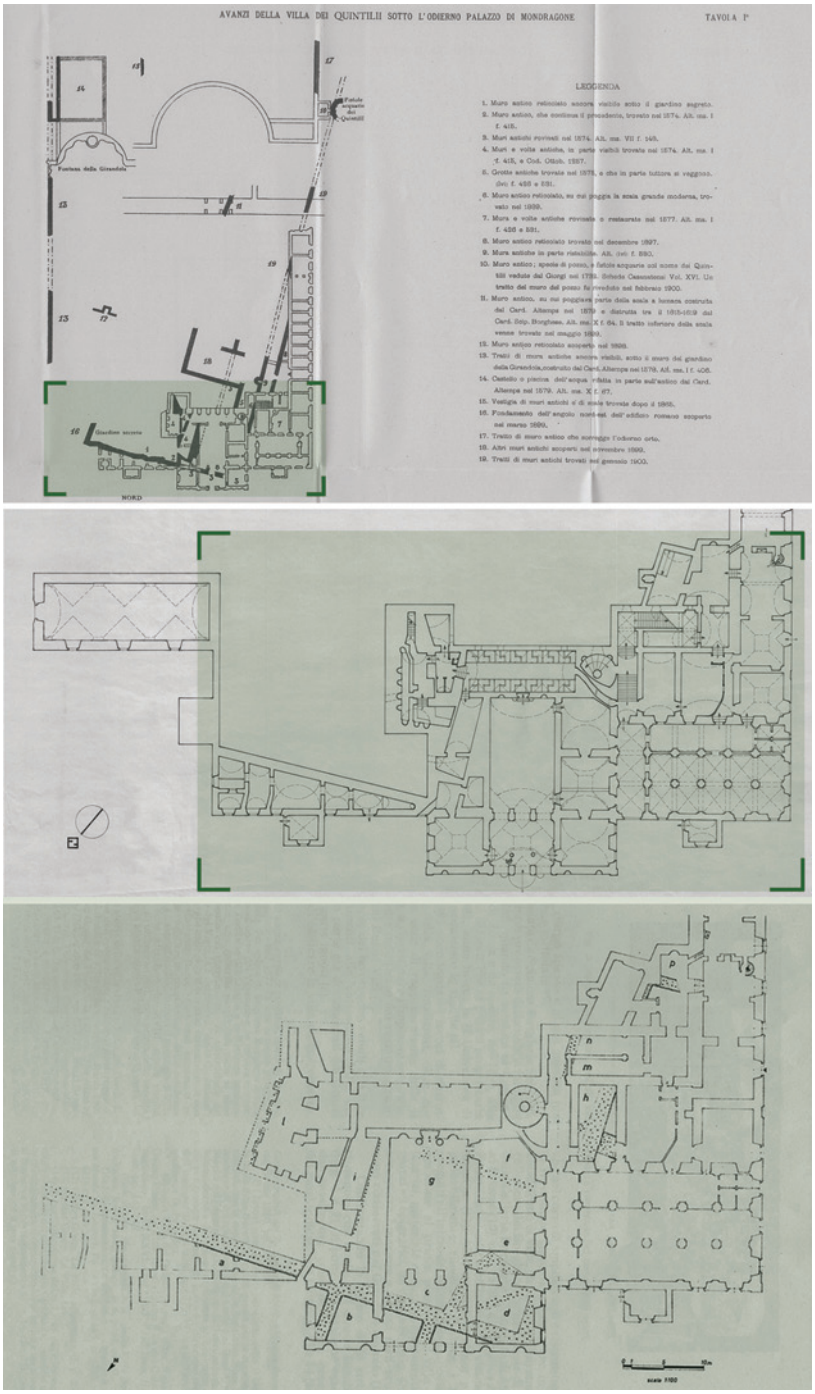

Fig. 3. Survey plans about ruins of Quintili's Villa in basement plan. From top: Grossi Gondi, 1901; University of Rome 'Tor Vergata', 1982; archaeological Superintendence of Lazio, 1987. Diagrams are not in scale and concerns areas gradually confined.

the one hand and the stairwell on the other hand, to allow the alignment of 3D point cloud with the one of the entire complex, that is still a work in progress. The post-processing of acquired data took place in ReCap 360 that allows to align the scans in only one points cloud, metrically and colorimetrically reliable. The transfer from points cloud to mesh (in Geomagic Studio) became indispensable to extract vertical and horizontal profiles of the model. Re-elaborating these vector data, exported in a Rhinoceros and, relying on cloud, it was possible to graphically represent, in AutoCAD, plans and sections of Roman masonries, subject of the study, as well as vaulted seventeenth century environment that houses it, updating, in this way, the existing planimetries, with a high degree of architectonical detail and metric accuracy (Fig. 4).

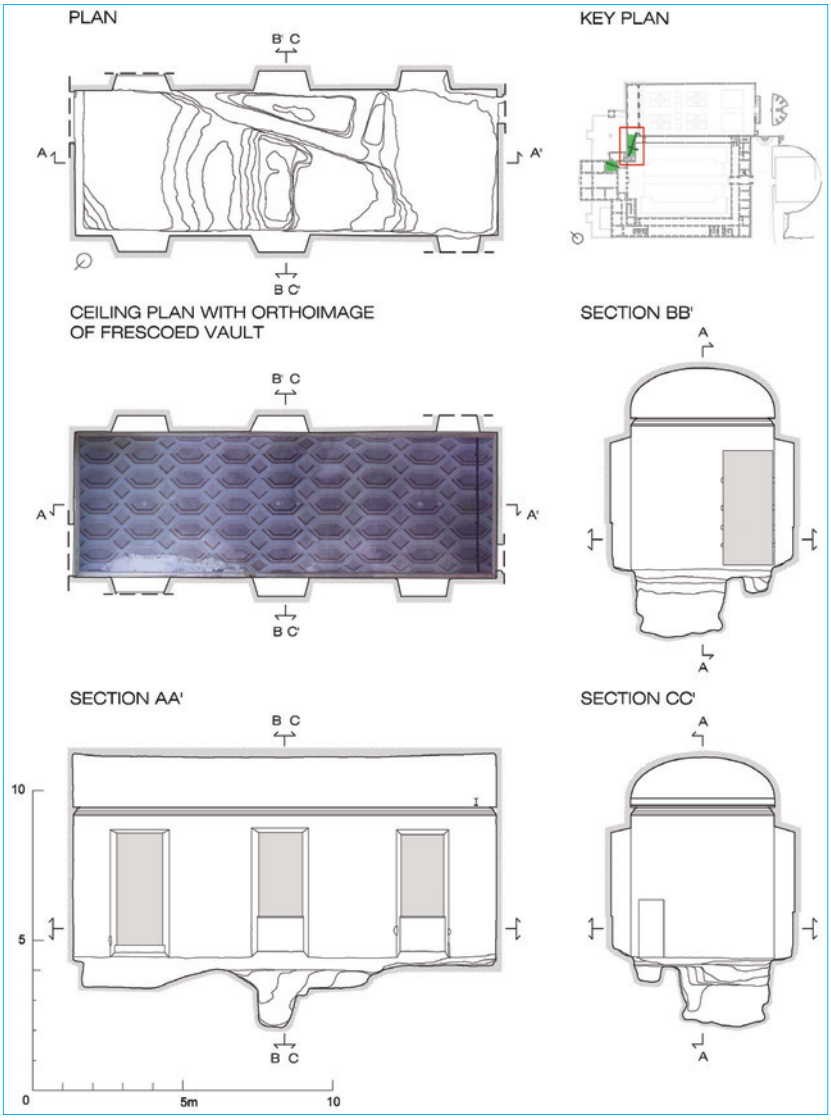

Fig. 4. Survey plans (unpublished) of Roman ruins to the Giardino della Girandola level

Conclusions

Thanks to the studies made on the historical building /architectural evolution of *Villa Mondragone* and to morphological validations based on three-dimensional surveys recently launched, it was possible to confirm that Vasanzio expanded the factory (obviously) keeping the orientation of the mesh set up by his predecessor, Martino Longhi il Vecchio. The remains of Roman villa at the level of *Giardino della Girandola* appears, again, rotated as compared to the masonries of modern system, maintaining a structure that corresponds to the other visible and wall fragment (under glass) in the first south-eastern room of the *Casino*, as well as to those on the floor below – including those that emerged in the mid-eighties of last century – and with those documented in *Piazzale Maggiore* in 1900 circa. During the Baroque phase of expansion of the Villas, the plannings dictated by forerunner systems dating back to Roman Age were extended at a regional level by the addition, in these improved residential complexes, of ancillary components – such as nymphs or water theaters – which also recalled the characters, althought nominally, of ancient villas. This contribution is part of a broader line of research on the territory and *Ville Tuscolane*, carried out within the activities of Laboratory of Survey and Architecture (LAREA) of the University of Rome 'Tor Vergata'. In particular, three-dimensional surveys just started on archaeological ruins found at *Villa Mondragone*, aim to create a three-dimensional computer graphics model of the entire artifact, in order to use it as a support tool for the research, the dissemination of scientific knowledge as well as the enhancement and the restoration of the assect. Although the paper is the result of a joint research, the authors report in agreement that the entitled paragraphs 'Historical introduction' and 'The Roman ruins in Villa Mondragone' are attributed to R. M. Strollo, while 'The surveys' and 'Conclusions' are attributed to S. D'Auria.

* *Fig.s 1, 2, 3 and 4 are made by authors. In particular, Fig. 3 is composed of images by different persons reported in the caption.*

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Among Topos, Geometry and Harmony: the Archaeological Site of the Greek Theatre of Akrai

Sebastiano Giuliano, Mariangela Liuzzo, Alessandro Russo

☞ Faculty of Engineering and Architecture, Kore University of Enna, Enna, Italy – sebastiano.giuliano@unikore.it; mariangela.liuzzo@unikore.it; axlruss@yahoo.it

✔ KEYWORDS: Greek Theatre, Site Survey, 3D Modelling, Multi-semantic Analysis, Landscape

ABSTRACT

The study is focused on the Greek Theatre of Akrai which was built during the III century BC together with the adjoining Bouleuterion. It was then uncovered by G. Iudica during the XIX century.

The monument lies within the ancient area of Akrai (SR), that today is an archaeological site that extends for nearly 35 hectares with an elevation of 770 m.

Following the three-dimensional survey, carried out with 3D laser scanner and GPS positioning, the study was organised into three different levels of analysis: the link between the archaeological site and the surrounding territory, the relationship between the monument with the surrounding landscape and the study of its geometric, architectonic and materialistic components that have been modified throughout the centuries.

Introduction (M. Liuzzo)

A structured understanding is necessary in order to fulfil the request of preservation with regards to the archaeological heritage. This understanding is based on multiple levels of semantics, capable of clarifying the ingrained complexity of the asset itself and of the physical, cultural and historical landscape to which it is intrinsically attached.

Modern digital information systems make it possible to transmit data relative to the cultural asset by means of instruments that facilitate various interactions. The relationships facilitated are, for example, those between visitors of the site and the site itself, as well as that between the individual monument and the landscape, of which it is an integral part. This transmission of data ultimately leads to the building of a single cultural framework to be enhanced and preserved.

The three-dimensional survey and virtual data and metadata processing instruments are well-established and make it possible to create 3D models that have the versatility to guarantee the transmission of information at various scales of morphological and thematic detail while producing files that are not too large.

Due to the inseparable relationship between monument and landscape, it is fascinating to be able to take advantage of the informative content tied to the interaction between point clouds and spherical photos that are used with the utmost scientific rigor. The first are intended to acquire both quantitative and qualitative information on the studied asset with elevated performance, while the second are aimed at the implementation of the content with the addition of the relationship with the surrounding landscape, geographically positioned and orientated.

The research proposes a methodical process aimed at reading the area of the Greek Theatre of *Akrai,* at Palazzolo Acreide (SR), according to a gradual and interrelated approach route and amplification of scale. The objective is to contribute to a widespread and in-depth understanding of the asset by means of a virtual and dynamic use of the asset itself. It further seeks to suggest, even remotely, of a relationship with the *topos* that is both empathetic and emotional as it unequivocally characterises the presence of archaeological assets on our territory.

The Site of Akrai (A. Russo)

The ancient city of *Akrai* stood perched atop a hill (roughly 770 meters), at the highest point of the plateau that characterises the south-east part of Sicily, flanked to the north by the Anapo River and to the south by the Tellaro River. The Corinthians in Syracuse founded the colony of *Akrai* in 663-664 BC in order to guarantee the control of the routes with both the Greek cities on the southern coast and the inland Sicilian cities. *Akrai* was ultimately guaranteed a stronghold due to the natural conformity of the steep ground as well as to the fortification work done over time. During the reign of Heroin II (275 – 215 BC), *Akrai* reached the height of its splendour and in fact its most notable monuments seem to date back to this period.
Akrai lost its strategic purpose during the Roman domination and it most likely became an agricultural centre as it was able to use the rich resources made available by its fertile territory. During the IV and V centuries the decline of *Akrai*'s urban centre began while small agricultural villages prospered in the outlying areas. It is most likely that the city was destroyed by the Arabs (perhaps in 827 AD) and that the surviving population dispersed itself among the countryside to then later regroup in a new location which was at a lower elevation and to the west of the original city (Fig. 1). The ancient city's walls and remains were turned into a stone quarry to be used as building material for the medieval Palazzolo and this is considered to be the initial cause of its destruction. This plundering underwent a sort of acceleration after the earthquake of 1693 as it destroyed Palazzolo. It was then rebuilt in another location even closer to *Akrai*'s location. It is probable that for this reason only small sections of the ancient site have survived up until today: traces of the city walls, the main roadway that connected the two city gates – the *Siracusana* and the *Salentina* – with several routes to other important city centres on the island, some side streets, the foundation of a temple, the theatre and the *bouleuterion*. These last two monuments identify the probable location of *Agorà* of *Akrai*. It was not central but on the eastern limits, just before the *Siracusana* Gate and the impressive rock quarries known as the *Latomie of Intagliata* and *Intagliatella*. It is possible that these quarries go back to the same period that *Akrai* was founded.

Studies of the Site (M. Liuzzo)

During the XVI century Fazello was the first scholar to ever identify *Akrai* with the current location of the archaeological area just west of Palazzolo (Bernabò Brea, 1956).

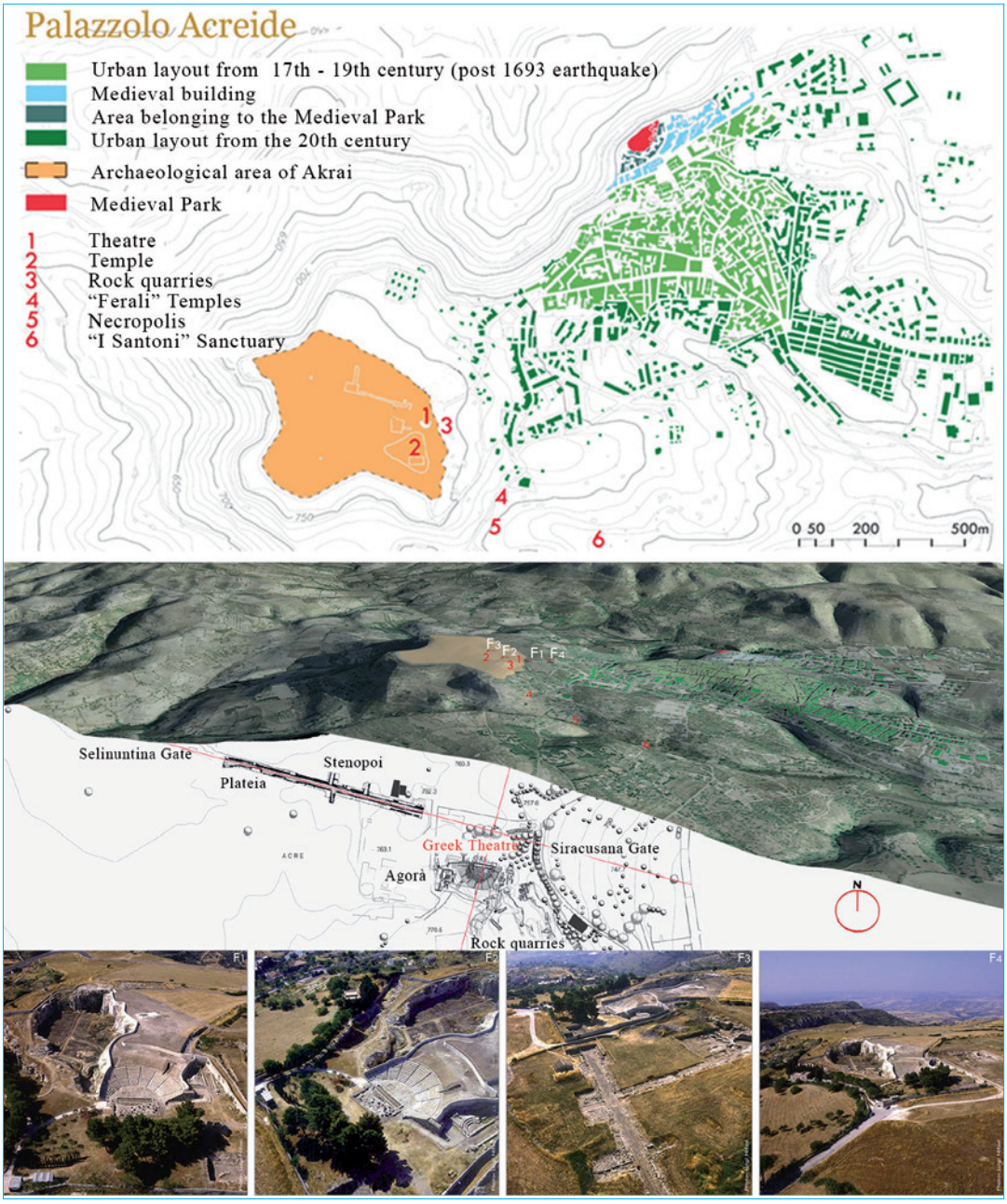

Fig. 1. Palazzolo Acreide. The archaeological area of Akrai's relationship with the ancient and current urban structure.

Not until the XIX century did the first archaeological digging activity actually begin in this area. It was commissioned by the local aristocrat Gabriele Iudica and documented in a publication of that time (Iudica, 1819).

The discovery of the *bouleuterion* (1820) and theatre (1824), on the other hand, date back to a subsequent phase of the study and were communicated synthetically in periodicals of the time without any sort of illustrated documentation.
In time many Italian and international studies followed. The first survey of the two monuments was done by Cavallari, which was carried out on behalf of the Duke of Serradifalco (Lo Faso Pietrasanta, 1842). It was then taken over by Mario Musumeci (1845) who was a collaborator of Cavallari and who further enriched the representation of the *bouleuterion* (Fig. 2). Koldewey's drawing (1901) then followed and was done for Puchstein's publication on Greek theatres, *Die Griechische Buhne*. It was then republished by Bulle (1928) in *Untersuchungen An Griechischen Theatern,* who conducted a detailed analysis of the Greek theatre.
With regard to the current study, the in-depth publication on *Akrai* by Bernabò Brea in 1956 is particularly significant. It includes notes regarding the digging campaign requested by him as well as the detailed surveys by Rosario Carta (Bernabò Brea, 1956).

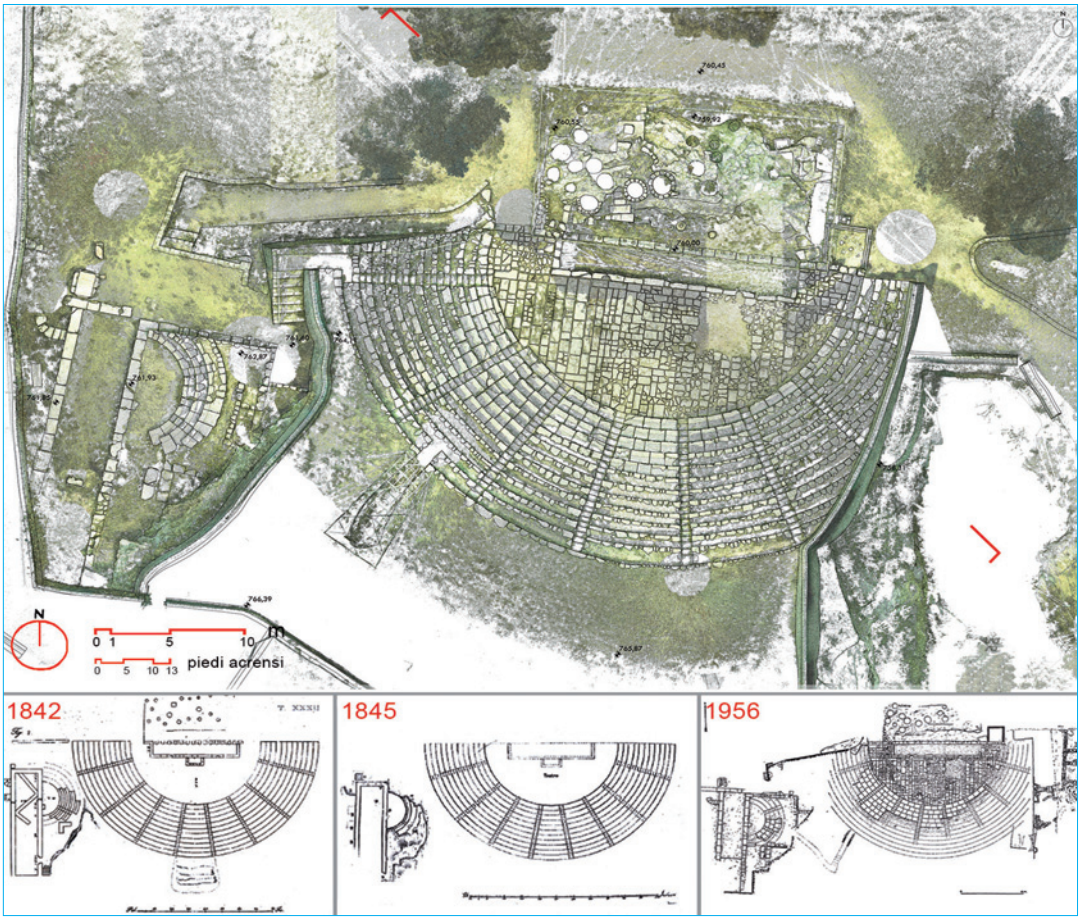

Fig. 2. The surveys of the Greek Theatre of Akrai. Above: 2015, 3D laser scanner. Below, historical surveys: 1842, survey by Cavallari for the Duke of Serradifalco; 1845, modified survey by M. Musumeci; 1956, survey by R. Carta for L. Bernabò Brea.

In 2015 the authors conducted a survey as part of the activities of the Survey and Representation Laboratory at KORE University of Enna.
Compared to past documented illustrations, this survey intended to focus not only on the individual monument, but also on the spatial interconnecting relationships between the monument itself and the nearby architectonic and territorial discoveries. Particular attention was paid to the relationship with the *bouleuterion* and the *latomie*, with which it creates an inseparable environmental *unicum*. For this reason, along with the planimetric representations, the vertical sections of the territory as well the three-dimensional views become extremely informative (Fig. 3). These representations clearly depict a morphologic sinuosity that contributes to creating a harmony of the *topos* once the limiting idea of the "not perfect" geometry of the theatre are overcome.

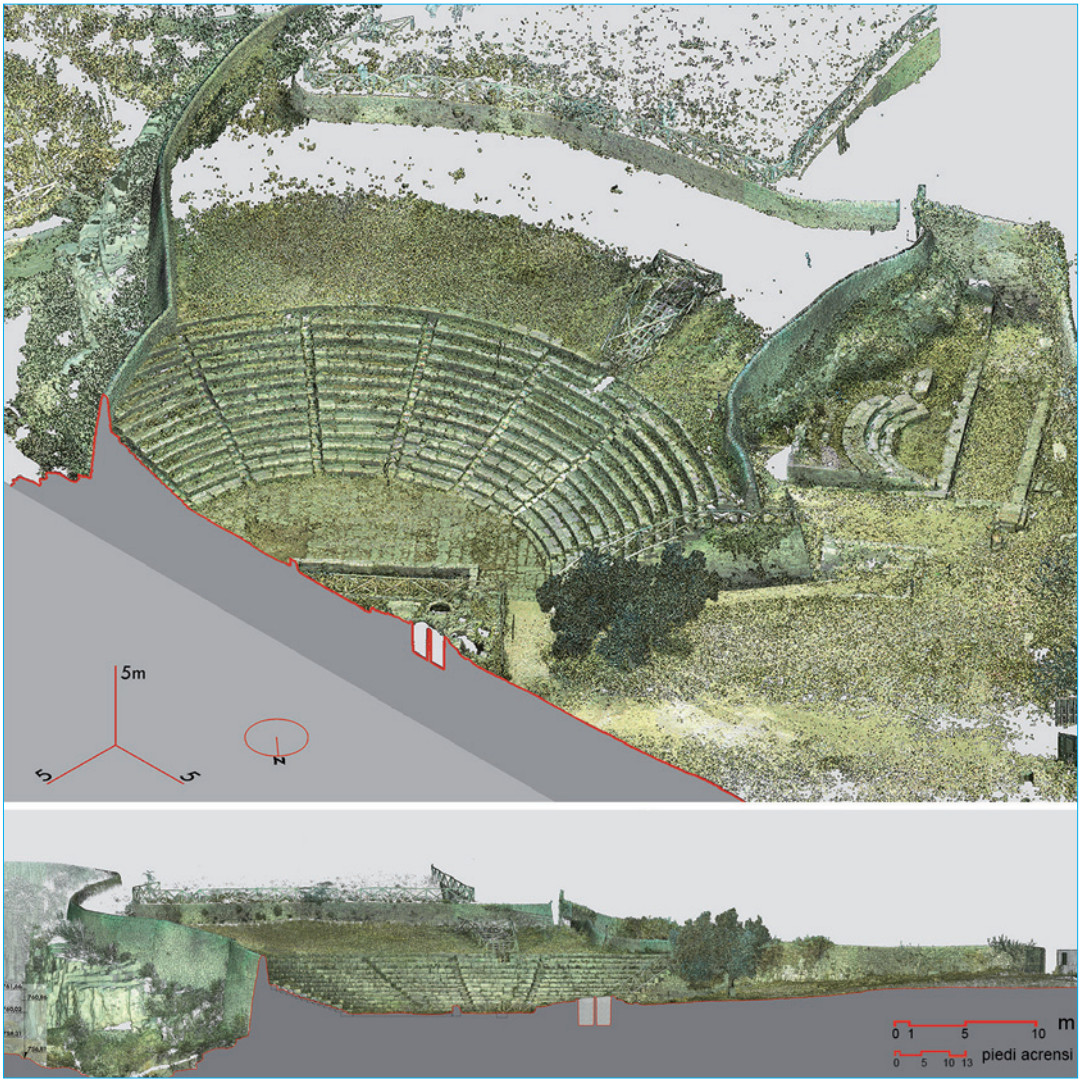

Fig. 3. Section of territory from the point cloud model of the Theatre of Akrai.

The Theatre and the Bouleuterion (A. Russo)

The theatre and *bouleuterion* are monuments that are symbolic of the site of *Akrai* and both date back to the period of splendour during the rule of Hiero II (III century BC).
With their semi-circular shape, theatre and orchestra are thought to be extremely rare as was not common for a Greek theatre to be of this shape. Its dimensions are also quite small. What is visible today is the result of the reconstruction efforts carried out by Iudica during the XIX century. Original areas of the theatre only include the foundation of the *skene*, the flooring of the orchestra, the lower steps, and some parts of the stairway of the cavea. Doubts therefore still remain on the exact dimensions of the theatre, on the number of steps, as well as on its contrasting "not canonical" positioning of retaining walls of the cavea. The size of the monument and the total of 12 steps, as reconstructed by Iudica, is certainly modest but at the same time, in line with the space available between the limits of the *bouleuterion* on one side and the rock quarry on the other. The reading of the monument in its original state and condition is made furthermore difficult by the numerous amount of changes done during the course of past centuries. For instance, there are very few remains of the Hellenistic *skene*, most likely destroyed during the Byzantine era during the construction of a mill which included numerous silos. From the Roman era instead, there is the rock flooring of the orchestra as well as the protruding *pulpitum* within its semicircle and a small rectangular area near the west entrance. A passageway within gallery is also very interesting because it is possible to reach the adjoining *bouleuterion* by crossing the rock cliff, against which the theatre leans. Its purpose was most likely to create direct access for the senate members to meet directly with the citizens when they held assembly or as direct access from the *agorà* to the theatre seating, but which was then ultimately suppressed by the building of the *bouleuterion*. It was discovered by Iudica 4 years prior to the theatre but remained partially buried until 1944 when it was unearthed by Bernabò Brea. Most likely, for this reason, its structure seems better preserved than that of the theatre. A synthesis of the description given is represented in the thematic representation (Fig. 4), aimed at efficiently sharing in-depth knowledge regarding the monument.

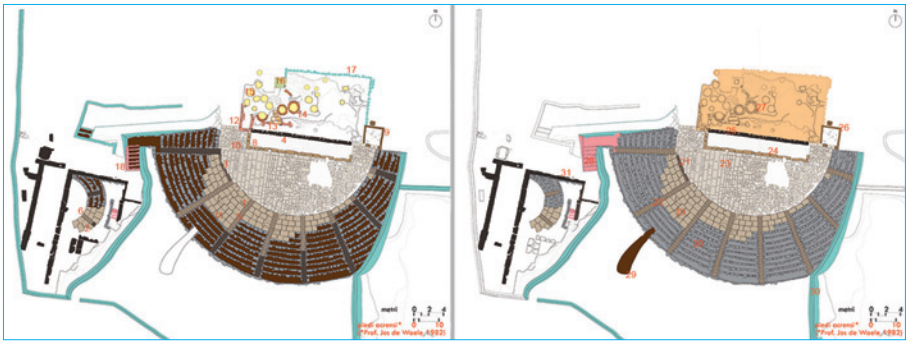

Fig. 4. Analysis of the building material and elements of the historical stratification. To the left, material elements: 1-8: square blocks of *calcarenite*; 9, 13: slabs of calcareous rock; 10: roughly shaped blocks of *calcarenite*; 12, 17, 18: various sized blocks of *calcarenite*; 14: clay; 15: calcareous rock formation; 16: concrete. Right, historical stratification elements: 19, 21, 22, 25, 29, 31: elements dating back to the III century BC; 20: reconstructed elements from the XIX century; 23, 24, 26: elements from the Roman Imperial period; 27: elements from the Byzantine period.

The Theatre and its Landscape (S. Giuliano)

A point cloud model of the theatre provides a scientifically acclaimed base for the reading of the studied architectonic work of art. From this base the processing of two and three dimensional models is made possible, even at elevated degrees of sharing capabilities.
For the Greek Theatre of *Akrai,* as with all ancient theatres, it is fundamental to set in place a methodical process that works towards a survey and drawing that not only include the theatre's architecture. It must in fact include all aspects, material and nonmaterial, that characterise its intrinsic and sensorial identity. We are dealing with an architecture that is in synch with the *topos* and surrounding landscape, designed to be enjoyed while immersed in an undoubtedly charming and natural setting. The setting is characterised by panoramic views to the north of the theatre that open up towards the territory of Etna while to the east, by the spectacular presence of the large *latomie* that look out towards the city of Syracuse.
The stage's backdrop is particularly impressive as it is well-defined by the high-grounds that border the Anapo Valley to the north with the towns of Buscemi, Cassaro, Ferla and Sortino. Behind these, in the distance, is the impressive mass that is Mount Etna, visible on the clearest of days (Bernabò Brea, 1956). Therefore, the objective of the study was to complete the cognitive framework on the Greek Theatre of *Akrai* with its landscape setting, taking advantage of highly informative photographic images. With the focus aimed in this direction the idea of using software that permitted the simultaneous visualisation of point cloud and spherical photos was exciting. The open source software called *Leica Tru View* was specifically used through the *Publisher* of *Leica Cyclone*. It was possible to navigate within the integrated model – point cloud and spherical photo – rotating freely around a stationary point from which were taken the shots integrated with survey laser scanning. Furthermore, it was possible to test the model by measuring and extracting geographic coordinates of individual points.
During the survey campaign *in situ,* careful attention was placed on the choice of the station points of the laser scanner. They were chosen with the dual objective of collecting, in the best way, both close range elements as well as the most important scenes of the surrounding landscape. More specifically, given that the morphology of the Greek theatre is set within the *topos*, a position was chosen from which the theatre offers 360 degrees of particularly charming scenery. From above the theatre's cavea, in fact, it is possible to admire the orchestra, the remains of the *skene*, the nearby monuments, the enchanting *latomie* as well as the Acrense landscape in all of its entirety (Fig. 5). A further objective during the experimentation phase was to free the representation of the landscape from the restrictive encoding scheme of the proprietary format of the images acquired by the survey instruments: the uncommon format of the images, the sequence of the acquisitions and the optimisation of the images themselves. With the *PTGui* software it was possible to create 360 degree, optimised and panoramic images of the site of *Akrai*. The images were both cylindrical and spherical, beginning from the images generated during the survey phase, using automatic algorithms, as well as with the possibility of manual interventions. As the Theatre of *Akrai* is currently used for theatrical shows, it is necessary to create *ad hoc* backdrops and stage scenery. For this reason, the final objec-

tive is that to also produce optimal spherical photos that can be used with the most common 3D modelling software, as an instrument of quality control for the project while respecting the ancient architecture and natural scenery that surrounds it.

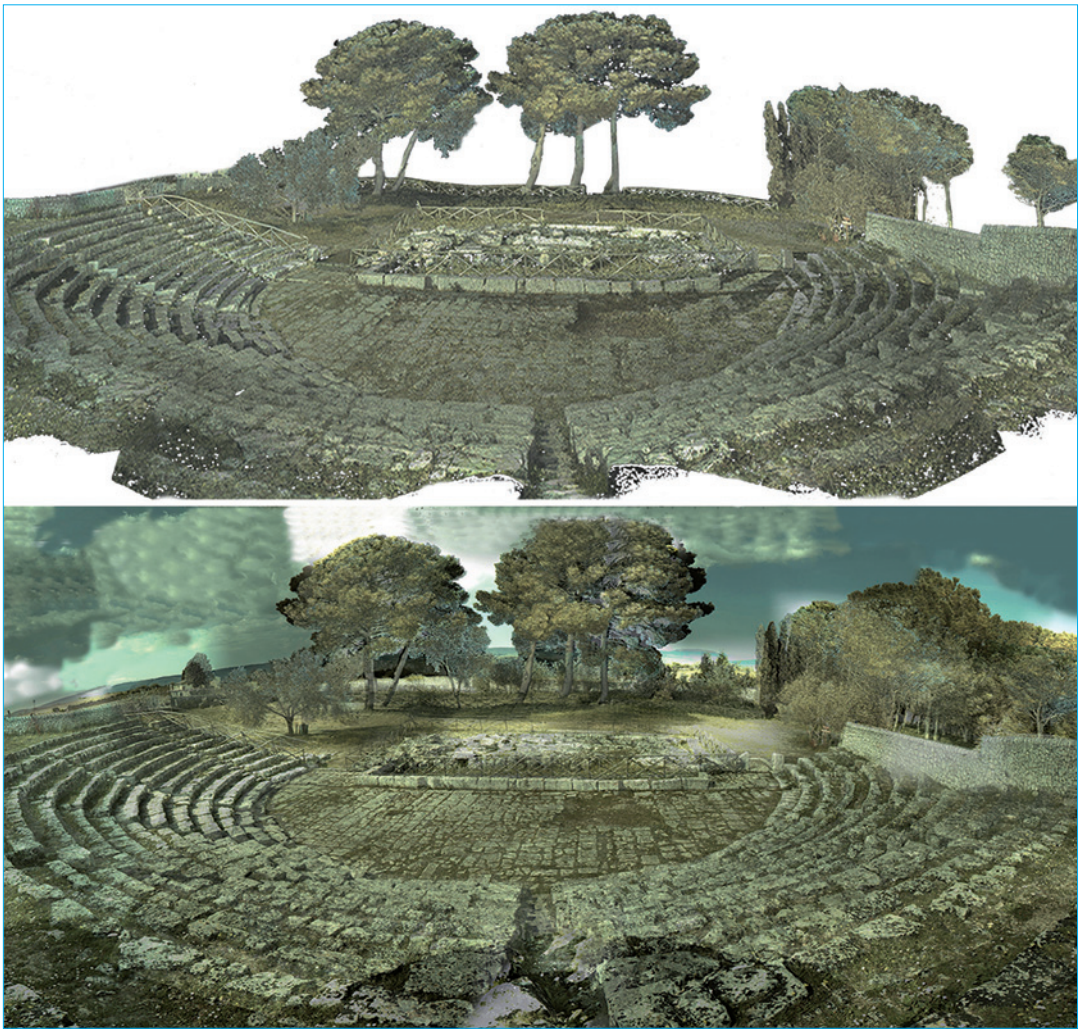

Fig. 5. The archaeological and landscape relationship in the model integrated with point cloud and spherical photos.

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Smart Industrial Archaeology

Mining Activity Along the *Via Ariminensis*

The Recovery of the Roman Consular and the Eighteenth Century Ironworks for the Enhancement of the Tuscan Tiber Valley Landscape

Daniela Cinti

DIDA, Dept. of Architecture, University of Florence, Florence, Italy
danielacinti@virgilio.it

KEYWORDS: Roman road, Archaeological area, Recovery, Rural landscape, Enjoyment

ABSTRACT: From the 3rd century B.C. an important Roman road, the *Via Ariminensis*, crossed the Tosco-Romagnolo Apennines. It was built to allow rapid movement of the legionaries that had to protect the northern border of the Republic, including the *Municipium* of Arezzo and the new colony of *Ariminum* (today's Rimini), founded in 268 B.C. The ancient road followed an articulated morphology of the Apennine territory, going up to the tops of the mountains and down to the narrow stream valleys. The route also crossed three vast alluvial plains that, alternating with the elevations, gave wide views of the rural landscape. These flat lands were formed by the Arno, Tiber and Marecchia Rivers, that started in the Apennines and then flowed downhill to the valley until reaching the Tyrrhenian or Adriatic Seas. The *Via Ariminensis* lost its importance in the 2nd century A.D., when a new one, called Cassia Nuova or Cassia Adrianea, was built in order to link Rome directly to Florence. So, Arezzo was disconnected from the main territorial roads of communication. After the 11th century, with the development of a rural mountain economy, the old Roman road assumed a new territorial role. In fact, it became a transhumance route, called Maremmana, because it linked the Apennine pastures to those in Maremma, vast coastal flat lands situated in the territory of Grosseto (Tuscany). Churches, castles and hamlets, as well as factories, were built along the road. In particular, in the Monti Rognosi there were copper and iron mines with a foundry for working metals, which today is an archaeological area. The *Via Ariminensis* maintained an important role until the 1960s, when many farmers and shepherds left the Apennines for urban areas that were developing in the Tuscan Tiber Valley or in nearby territories. As a consequence, long sections of the old Roman road were abandoned and forgotten. In the last ten years the Union of Mountain Municipalities of the Tuscan Tiber Valley has promoted and carried out the integrated programme aimed at the improvement of the rural landscape of the Park of Monti Rognosi and Sovara Valley. It has identified the *Via Ariminensis* as the structural axis of the territorial project, that links cultural, archaeological and environmental resources as well as accommodation facilities (farmhouses, etc.). So, the Roman road has reacquired its role as a territorial route in a mountain environment. In fact, it links the archaeological area of the Ironworks, Visitor Centre and other cultural and landscape assets.

Continuity and fractures in the history of a rural landscape

The *Via Ariminensis* linked two settlements that were strategic for Roman defence against the Gauls: Arezzo (*Arretium*), an Etruscan town conquered in 295 B.C., and Rimini, built on the

Adriatic coast near the mouth of the *Ariminus* river (today's Marecchia). In particular, these two garrisons had a significant role in the Second Punic War. The Consul Flaminio camped his legions to the north of Arezzo (in the large area between the *Cassia Vetus* and the *Ariminensis*) when Hannibal unexpectedly passed to the west of Arezzo heading towards Lake Trasimeno and Rome. The Consul decided to follow the enemy without waiting for legions coming from Rimini and fell into the ambush organized by the army of the Carthaginian General (Bacci, 1985). *Ariminum*, like *Arretium*, had a permanent military camp with many legionaries to be sent if necessary. So, the Roman road that linked the two towns had an important military role. It was marked by *castrum*, which oversaw the territory and protected the armies during their stops. Often these places are still remembered today by their Roman place-names; Papiano, La Marca and Castro in the Tuscan Tiber Valley are some examples. The east-west connection between the Apennine area and the Adriatic coast was important, not only for military activities but also for business exchanges. In fact, the *Cassia Vetus* passed through *Arretium*, going south to Rome and north to Fiesole (a town of Etruscan origin situated near *Florentia,* a colony founded in the 1st century B.C.). Important consular roads also crossed *Ariminum*; these linked southern regions to northern ones. The main road, Via Flaminia, going from Rome to Rimini, was built for military purposes around 220 B.C. Later Via Emilia was built in 187 B.C., going from Rimini to Piacenza.

So, the *Ariminensis,* built at the end of the 3rd century B.C., created a "quadrilateral" of roads together with the same Flaminia and the *Cassia Vetus*, whose vertexes coincided with the cities of Rome, Fano, Rimini and Arezzo (Fig. 1). After the construction of the *Ariminensis* these strong-

Fig. 1. The main Roman roads in central Italy. Via Ariminenis is highlighted in red, Via Cassia Vetus in orange, Via Flaminia in violet. Cartographic base from: "Reference Map of Ancient Italy. Northern Part.", "Historical Atlas" by William Shepherd, University of Texas Libraries, Austin, USA, 1923-1926. (Road layout of Via Ariminensis: D. Cinti)

holds were perfectly connected to each other, allowing rapid movement of the legions that had to protect the Roman Republic and conquer new territories in the north (Cisalpine Gaul, etc.). The road to Rimini lost its importance in the 2nd century A.D., when a new one, called Cassia Nuova or Cassia Adrianea, was built in order to link Rome directly to Florence. So, Arezzo was disconnected from the main territorial roads of communication. In Imperial times the *Ariminensis* had a prevalently local role (vicinal road) that it maintained even in the early Middle Ages. However, in the latter period, churches (Pieve of S. Ilario in Ponte alla Piera, etc.), abbeys (S. Michele Arcangelo in Badia Tedalda, etc.) and defence strongholds (the Castle of the Counts of Galbino in Papiano, etc.) began to develop along the old Roman road or near it, a prelude to its rebirth starting in the late Middle Ages.

After the 11th century, with the development of a rural mountain economy, the old Roman road assumed a new territorial role. In fact, it became a transhumance route, called Maremmana, because it linked the Apennine pastures to those in Maremma, vast coastal flat lands situated in the territory of Grosseto (Tuscany). In spring and summer large herds of cattle, mainly sheep and cows, lived in the pastures of the Apennines which were cool and rich in grass, while in autumn they went to areas along the coast of the Tyrrhenian Sea where the climate was mild and there was an abundance of food. The cattle, guided by shepherds, returned to the mountain fields at the end of winter. The old Roman road maintained this territorial role until the 1960s. Old local people still remember long lines of sheep and cows moving on the Via Maremmana and shepherds stopping in the small hospitality facilities situated along the route. In these mountain areas, isolated and far from main urban centres, the passage of shepherds and wayfarers allowed cultural exchanges that enriched the territory and the local communities.

After the Second World War, many shepherds and farmers left these mountain territories going to urbanized areas and leaving numerous small farms uncultivated. In a few years, the custom of transhumance fell into disuse due to a decrease in the number of mountain breeding farms and crops. In vast man-made territories a slow process of renaturation led to the disappearance of the old Roman road, which was overrun by shrubs and trees; only some agricultural fields have continued to be used for cultivation.

So, for more than two thousand years, the *Ariminensis* has been an important road axis that has structured the surrounding rural landscape, becoming a landmark for settlements and activities. Along this route or near it, medieval hamlets, castles and churches have been built, as well as "factories". For this reason, the territory of Monti Rognosi in the Tuscan Tiber Valley is particularly significant. Its ophiolitic elevations, formed of magmatic rocks coming from the ocean, are rich in minerals (mainly copper and iron) that have been extracted since the Copper Age.

In the second half of the 18th century, the Gran Duke of Tuscany promoted the recovery of mining activities in this territory and had a metallurgic foundry of about 1,300 square metres built. It was located in the proximity of the old *Ariminensis* road (or Maremmana) and along the Sovara stream, a source of water power, indispensable for the working of the "iron mills". Due to changes in Grand Ducal politics, the Ironworks was abandoned only a few years after its construction and in the first decades of 19th century it was already in ruins. Its wall structures, with time, were covered with earth and overrun by weeds or destroyed by the waters

of the nearby stream. At the moment of restoration, along the Sovara only one part of the walls of the old "iron mill" was visible.
Now, the archaeological area of the Ironworks and the nearby section of the Roman road are inside the Regional Natural Reserve of the Monti Rognosi, a territory of great geological and vegetational importance. The protected area was created in 1998. The urbanistic plans of the township of Anghiari has recently identified a vaster area called Park of Monti Rognosi and Sovara Valley that includes the Regional Natural Reserve. The Union of Mountain Municipalities of the Tuscan Tiber Valley, through an integrated programme, has promoted new interest in this territory, carrying out a series of interventions aimed at the enhancement and public usability of the mountain landscape.

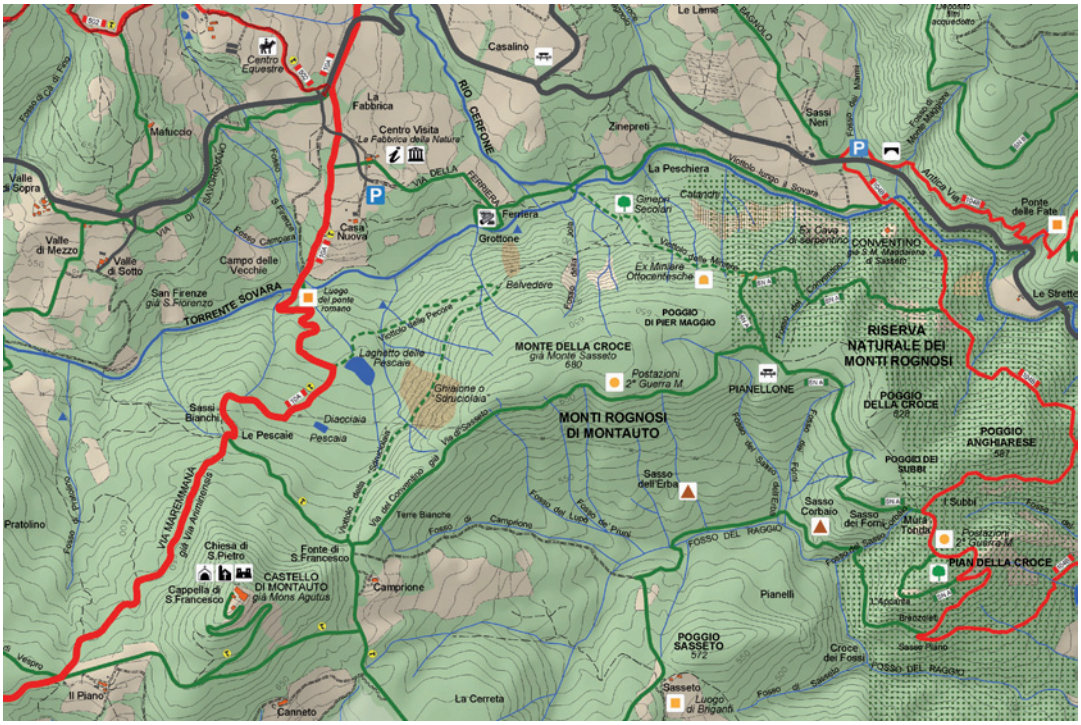

Fig. 2. Map of the territory of Monti Rognosi and Sovara Valley (scale: 1:10,000) with Via Ariminensis and many other paths and features (geological, cultural, etc.). (Graphic design and contents: D. Cinti)

The recovery of the Roman road and the ironworks for the enhancement of the rural landscape

In the last ten years the Union of Mountain Municipalities of the Tuscan Tiber Valley has promoted and carried out the integrated programme aimed at the improvement of the rural landscape of the Park of Monti Rognosi and Sovara Valley. It has identified the *Via Ariminensis* as the structural axis of the territorial project, that links cultural, archaeological and environmental resources as well as accommodation facilities (farmhouses, etc.). A section of approximately 10 km, situated inside the park, has thus been recovered to be used for cycling, walking

and horse-riding routes, rich in significances and history. The Roman road has reacquired its role as a territorial axis in a mountain environment studded with historical settlements.
Rural hamlets, castles, churches and old plants are once again connected by a system of routes, focused on the *Via Arminensis*. Many minor roads branch off from the old Roman way. These restored routes allow a "slow usability" that is suitable for stops and continuous views of a rediscovered landscape. The major road as well as the minor ones have thus become an open air museum, along which cultural and environmental resources can be admired, all enhanced by coordinated directional signs and illustrated panels that help visitors to learn about the territory, local history and traditions.
The first phase of the project was characterised by in-depth bibliographical studies, by a careful reading of historical maps and surveys with GPS. It was thus possible to determine the original layout of the *Via Ariminensis,* which was no longer visible due to the thick vegetation that had covered the carriageway. The identified historic routes were then drawn on the regional cartography (scale 1:10.000) by means of a GIS program (Fig. 2). Thus an updated hiking map was created and now tourists can enjoy using a network of paths. Many landmarks were also highlighted on this map, for example "historical, architectural and archaeological properties" and "naturalistic features", as well as accommodations, recreational and educational facilities (Visitors Centre, etc.).
The Union of Mountain Municipalities of the Tuscan Tiber Valley, with the contribution of the University of Florence, has thus been able to identify the layout of the historic road present in the territory. Surveys of the rural landscape were followed by the recovery of sections of the major and minor routes, reconstructing an organic system of paths. Through minimal interventions and in synergy with the surrounding environment, the Union of Mountain Municipalities succeeded in revitalizing rural centres and natural sites that had been forgotten.
In particular, the main works done on the *Via Ariminensis* have concerned the restoration of the abandoned and re-naturalised carriageway, giving back continuity to the route and re-establishing the links for cycling, walking and horse-riding. Archaeological digs weren't carried out during the works. In the near future, they would need to be done in order to verify the presence of paving stones, even though many roman roads had packed earth surfaces (Fig. 3).
Detailed interventions followed the most important works. Among the main ones were: the rebuilding of the dry stone walls retaining the slopes along the road; the improvement of the sections of the carriageway crossed by ditches with stone slabs; the placement of pedestrian stepping stones across the Sovara stream using rocks put in the riverbed (Fig. 4). The carriageway was renovated with stone chippings of various sizes, using the smaller ones for the surface finishing. The works also tried to reconstitute the historic relationships between the Roman road and the morphology of the land. The synergy with the ditches and streams was particularly significant. In Roman times, stone bridges were, in fact, an exception and the watercourses that came down into the narrow valleys usually crossed the roads. So, those who travelled on the old mountain routes had a continuous relationship with watercourses,

Fig. 3. On the upper left - An abandoned section of the *Via Ariminensis* overrun by trees and shrubs that made it inaccessible. On the lower left: The new directional signs of the *Via Ariminensis*. On the right: A section of the restored *Via Arminensis*. (Photos, design and construction supervision: D. Cinti)

Fig. 4. A privileged relationship: historic routes and watercourses. The interventions on the *Via Ariminensis* were made in harmony with the morphology and the surrounding environment. (Photos, design and construction supervision: D. Cinti).

that provided a succession of landmarks along the roads; every ditch or stream crossed had a specific name, marking the various stages along the routes.
Importance has also been given to the planning and design of the directional signs and the illustrative panels, facilitating movement in the territory and providing knowledge of its main values. Visitors can move easily, having all the necessary information for following the different itineraries. The most significant one leads the visitor, who walks on the Roman road, to the discovery of places that in antiquity carried out mining activities on the Monti Rognosi and in the Sovara Valley. Particularly characteristic are the ruins of the 18th century foundry, most of which was rediscovered during digging done in 2012. The archaeological area of the Ironworks, enriched from recent findings, was recovered and made accessible to the public. Besides the consolidation of the remains of the walls, works continued enhancing the open spaces and protecting the left bank of the Sovara stream, along which the original foundry was built. Its ruins were severely damaged from flood waters that reached the foot of the Ironworks walls. This bank was reinforced with local stones, assembled dry, that integrate themselves in the riparian environment of the stream. The project tried to renovate the old relationships between the Ironworks and the river that had been interrupted by centuries of abandonment (Fig. 5). The construction of new synergies between water and restored ruins

Fig. 5. Archaeological area of the Ironworks after the recovery of the remaining walls and the requalification of open spaces. In the foreground the Sovara stream can be seen with the bank reinforced by stones coming from the area. (Photo, design and construction supervision: D. Cinti).

generates emotions from the past, enhanced by imposing natural landscapes, that overlook places where man has lived.

The enjoyment of the landscape

Every little section of the re-found and restored road, every part of the rediscovered Ironworks has represented an indispensable "tile" for the reconstruction of the forgotten landscape, giving it a new role thanks to the presence of territorial values. A system of minimal interventions develops among the remaining fields, woods and the riparian vegetation strips. The walk through old landscapes begins and is characterised by accentuated descents, by endless ascents and by ditches and streams. The historic roads follow the morphology of the slopes, ridges and knolls, from which wide forgotten views and glimpses emerge.
So, significant results have arisen from the collaboration between the University and Union of Mountain Municipalities, allowing the carrying out of a strategic programme defined by research strictly tied to the territory, to its origins and traditions still alive in the communities of the area. Local people were involved both in the recovery of the sites, that had lost their own identity due to abandonment, and in the definition of the old place-names as well as in the recounting of legends and traditions that have increased visitors' interest in the area.

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Canals, Water and Production in Fabriano's History: Study For The Construction of a Recovery Strategy and Development of Local Traditions

Enrica Petrucci[a], Gloria Buscarini[b]

[a] School of Architecture and Design, University of Camerino, Ascoli Piceno, Italy enrica.petrucci@unicam.it
[b] gloriabuscarini@hotmail.it

KEYWORDS: knowledge, local identity, fruition, development

ABSTRACT

The goal of this research is oriented to verifying a method, based on both physical recovery of infrastructure, and on the construction of new paths of knowledge/fruition. The analysis of historical archived sources and studying architecture in its material-figural consistency, represent the first unavoidable step towards the construction of an effective recovery strategy, and an enhancement of local traditions. Specifically, this case study refers to the town of Fabriano in the Marche region, where you can analyse a system of particularly complex natural and man-made canals. From the most ancient times, this system was structured in parallel to the development of crafts that have honoured the city, both nationally and internationally, until the end of the nineteenth century.

In the town of Fabriano, the processes of transformation of traditional production systems have been accompanied by changes to the urban structure, with obvious problems of preservation of natural and man-made resources, which are closely linked to such production. The now disused factories and the old supply systems are bearers of tangible and intangible values that could contribute to building a cultural identity, stimulating new forms of local tourism.
To understand the city's transformation processes, it is necessary to refer to historical and archival sources, according to which, Fabriano was born shortly before 1165, by the union of two castles. The first territorial political structure showed different characteristics compared to other Marche cities. Indeed, it witnessed inactivity by institutional figures, such as the bishop, being replaced by small and difficult to manage laity or monastic groups. Even after the mid-twelfth century, a number of noble families had acquired power, creating a municipal organization (Luzzatto, 1909). The political role of the craft guilds emerged during the mid-thirteenth century. These were actively involved in the management of power, and knew how to interpret the productive vocation of Fabriano, developing commercial activities of national and European prominence (Angelelli, 1932). Many testimonies can verify the progressive affirmation of Fabriano workshops both on numerous Italian city markets (Rome, Genoa, Florence, Venice) and abroad (Provence, northern France and Spain).
In the mid-thirteenth century, weak craft unions, who had enjoyed the privilege of exclusively practicing a trade had become powerful and autonomous corporations, indeed, proper political and economic bodies that shared power with the nobility. Moreover, they had their own statutes annually approved by the municipal authorities, and they ensured protection and mutual assistance to their affiliates (Avarucci-Paoli, 1999). These were obliged to strictly ob-

serve regulations and religious practices, to apply the prescribed technical procedures for the processing of individual artefacts, which underwent quality and quantity inspections (Zonghi, 1880). Working hours had to be respected, as well as prices and wages. Internal hierarchies foresaw the division of labour into three functional categories (masters, labourers, apprentices). Activities were carried out in production facilities specially crafted inside and outside the town walls (Fig. 1).

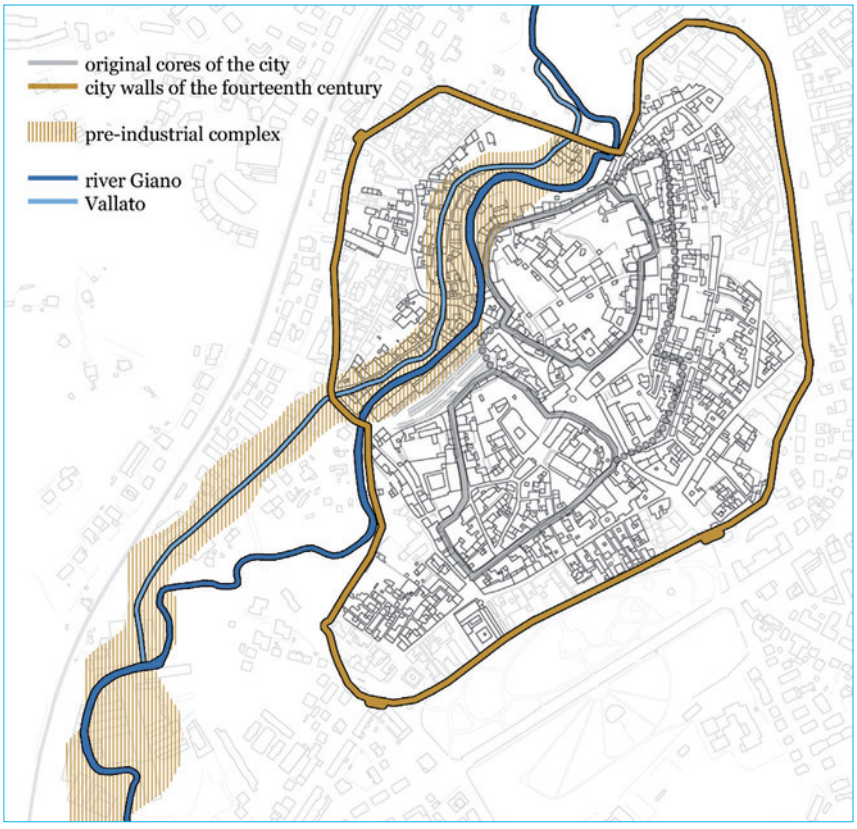

Fig. 1. The development of the town of Fabriano between the thirteenth and fourteenth century. Highlights the course of the River Giano and the path of Vallato, crossing the higher concentration of protoindustruali complex zone (G.Bugiardini reconstructive drawing)

The guilds of Arts and Crafts played a decisive role in communal life as of the second half of the thirteenth century, as shown by the first known document, which is dated 30 September 1278, in which the names of Consuls and Captains of the 12 Arts are mentioned, who, with the powers and responsibilities of the General Council of the Municipality elect Podestà Orso Orsini, the nephew of Nicholas III. Documents, historians give the exact size and importance that the Arts had reached in power, highlight the crucial role they played over a vast territory, among the most important of Marche for its gradually developing economy.
The oldest production activity is related to the blacksmith's craft, from the beginning of the early medieval settlements. The Art of blacksmith's figure was cited in the list of 1278, but

evidently groups of artisans dedicated to metal-working had penetrated the Fabriano community in a much earlier era, rising up to become a symbol of the traditionally hard working people who had settled in the Giano valley, and entering the world of folk legends that exalt the figure of the blacksmith (faber in amne cudit). It is however established that on the thirteenth century's seal of the city there was a workman, with the hammer in his right hand and tongs in his left, intent on beating iron on an anvil.

In its first municipal conformation, in the early Middle Ages, the city had an organic development with the River Giano, acquiring its morphology and exploiting opportunities to create the conditions of intense production and commercial development. Along its banks, a number of major factories had settled since the thirteenth century, which would have characterised the city in the following centuries (Lipparoni,1990). These buildings were a proper proto-industrial system, based on a valley-artifacts-river relationship. Fabriano's urban form has been transformed over time, establishing strong connections with the "waterways: a city that overlooked a river, its canals and valleys, in a perfect anthropological and functional balance". These signs have strongly characterised the human and productive habitats for centuries, but are no longer recognisable these days. Fabriano reached its greatest extent in terms of space and "industrial development" at the beginning of the fourteenth century. This coincided with the construction of new walls and the creation of major waterworks; drawing water from the River Giano using specially designed locks, its people built a man-made canal called the *Vallato* (Carancini, 2014).

Illustrating such a complex feat of engineering entails highlighting the ingenuity and industriousness of Fabriano, in order to unravel one of the town's and all its territory's productive "secret". The hydraulic work exploited the natural river's height difference (a waterfall or more likely a rapid) that was used power the craft activities (paper mills, wool cloth-making, tanneries, forges and mills) to a level of several metres higher than the river's level. The waters of *Vallato* were employed, both to create the driving force for production machinery, and to keep the river flow under control, and also to differentiate the factory run-off water, in order to safeguard the health of the stretch of river inside the walls (Biondi, 1978).

The *Vallato* branched off from River Giano where the current Cartiere Miliani stands, through a bulkhead that regulated the water's flow. This metallic barrier was raised or lowered from the upper floor by a "screw" system, sliding along two side rails. Within the city, they distinguished three main sections: the *Vallato Cupo*, deeper, positioned upstream; *the Vallato Comune*, that it had several smaller channels to allow one "Municipal" exploitation of natural waters; the *Vallato Molendinorum*, its last stretch that poured its waters just outside the city walls, at the Moline bridge (Fig. 2).

Among the most representative areas for the concentration of factories that exploited the Vallato waters, there is an area called "Le Conce" for the presence of a thriving industry of tanning hides which had a notable development from 1200 to early 1800. Until the seventeenth century there were 18 tanneries in Fabriano, which gradually began to suffer, and eventually disappear altogether. These factories which partly still dot the course of the river, drew the water they needed to function through a system of man-made canals.

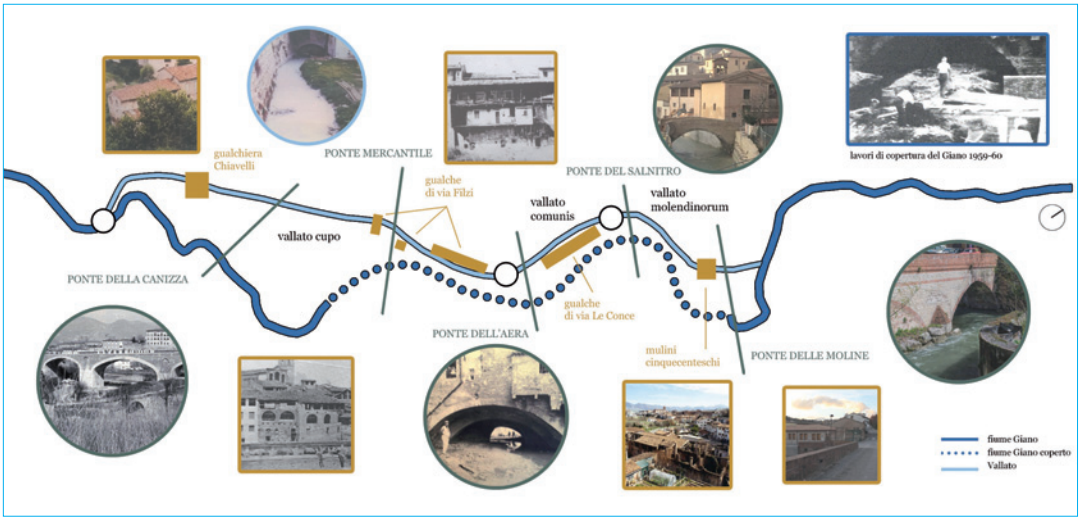

Fig. 2. The River Giano and the Vallato with the identification of the various sections and the significant elements along the way that might be of interest for a new strategy (G.Bugiardini reconstructive drawing)

With the collapse of original activities, canals were buried and were replaced by streets to access the shops and warehouses that have gradually replaced industrial activities, hence the numerous modifications and tampering with the external openings, as well as the creation of environments that have fragmented the original spatial continuity.

These mills had a very similar architectural style and construction. They consisted of a basement where the first stages of processing were carried out. In these places, there were the tanks and boilers where skins or wool were soaked in specific solutions. Premises open to the public were located on the ground floor. They were well lit, with easy and instant access where the packaging and sale of products was focused. They were connected internally with stairs, generally located on head or dividing walls. The upper floors were divided into large rooms that housed the drying rooms where sheets of paper, wool or leather, depending on the type of craft were placed to dry.

These premises were characterised on their facade by wooden trellises, providing fresh air, allowing air to circulate drying the valuable products. The rest of the wall was made of brick, a widely used material in the city due to the presence of many furnaces, which had also been active since the Middle Ages and met the same statutory rules governing other craft activities (Fig. 3).

The historical and urban value of the factories is highlighted by the Superintendence for Architectural Heritage of Marche that, by placing its seal of protection, underlined «For the formal and typological and structural characteristics that distinguish them clearly, while in the vast and varied construction landscape of the old town of Fabriano, and for their intrinsic historical value such testimony remains as artefacts, with whose productive activity these buildings have greatly influenced the economic history of the city, the aforementioned buildings, therefore, are deemed worthy of preservation».

Fig. 3. One of the most interesting factories along Via delle Conce; the building was used as a tannery and then to other crafts, until the abandonment which occurred in the mid-80s (drawing of G.Bugiardini)

At the end of the nineteenth century, the "Conce" area, so strongly was it characterised by the presence of canals and related architectural structures, had lost its original connotation and was abandoned; also the canals and the supply of water were subject to a long slow oblivion (Castagnari, 1986). Long abandoned, these buildings mostly show a state of advanced deterioration. The *Vallato* was subject to an inexorable burying operation, as was the River Giano, too (Fig. 4).

A first attempt to give relevance to the Fabriano water system was undertaken by the Superintendent Icilio Bocci, who had published a short treatise devoted to "Il ponte dell'Aéra e l'Ospedale di Santa Maria del Buon Gesù", (Bocci, 1907). In that study, he described the river and its artefacts, including the «so-called Aéra Bridge, over the River Giano, notable for its solidity and construction, because it rests on a column supported by six houses and a section of the highway, and was capable to resist the river's current». The work went up to the honour of the universal chronicle five centuries ago, when Giorgio Vasari cites it as an extraordinary work by Bernardo Rossellino, built in 1449. The bridge certainly underwent major transformations over the centuries, right up to its current complex constructive articulation. Despite the architectural importance of the building, the bridge is unknown to most of Fabriano's inhabitants, as indeed is its entire water system, both natural and man-made, which has gouged the centre of Fabriano for centuries.

Many authoritative historians are interested in the River Giano, its canals and bridges, without achieving a level of detail so as to understand its characteristics and architectural style and the

real importance as a basic urban infrastructure in the fabric of Fabriano. The definitive forgetfulness came with the 'filling' of the river, carried out in mid 1900s for hygienic and health reasons. The lack of information, alleged by Bocci, lasted until the late nineteenth century. From that time onwards, some development projects have been initiated in order to discover the signs of such important figures in history, but despite several attempts their results are still not apparent. Among these initiatives there is the restoration of the former Fabriano Tannery. This fell within a broader recovery programme of the entire River Giano valley, and foresaw amongst others things, improvements in terms of roads, parking lots, hydraulic arrangement and re-qualification of the watercourse (Keoma-Conforti, 2011), in addition to the reorganisation of the surrounding environmental system (Fig.s 5-6).

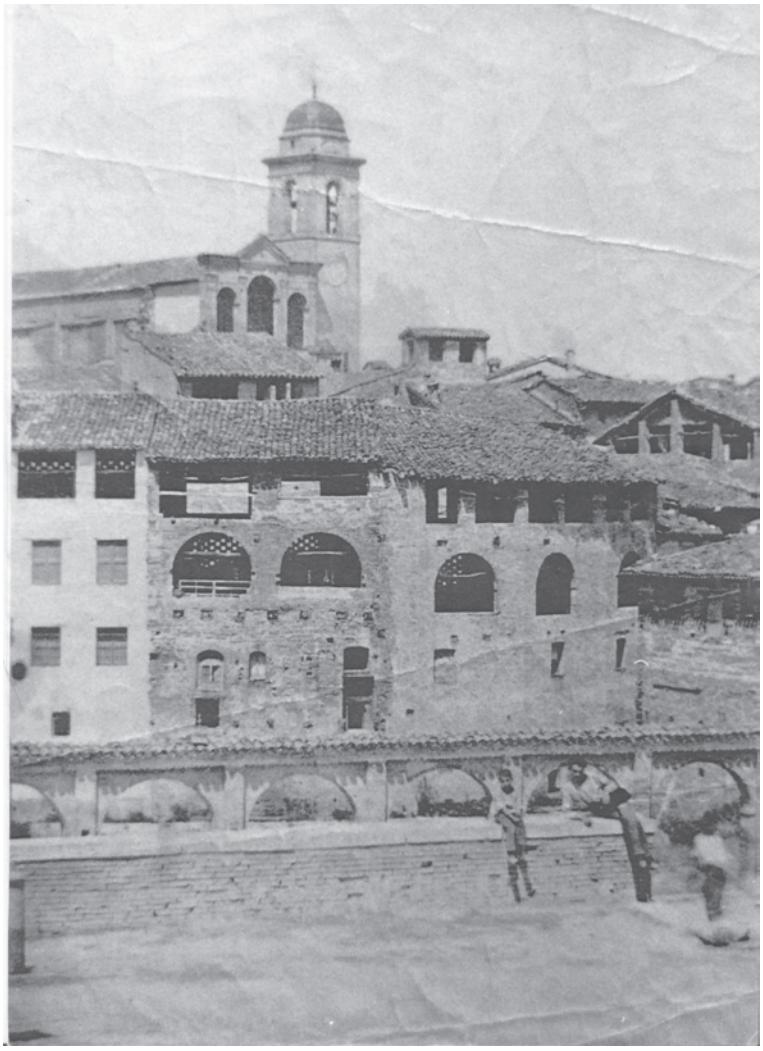

Fig. 4. The "Conce" area, in the early '900. It was characterized by the presence of canals and related architectures with crafted function (private collection)

Fig.s 5 and 6. Recently, the Giano River has been affected by some restorations and some sections have been uncovered and enhanced (photos of G.Buscarini)

Conclusions

As already noted, the history of the city of Fabriano is closely linked with its waterways, just as it was on the banks of its rivers when the town developed and settled in the course of centuries, the various productive activities, vectors of development and prosperity for the city and its territory. The conservation project of waterways and related handicrafts represents an initial essential element, but it is equally necessary to proceed with a more complex development strategy that can grasp new opportunities for development. What this means is to start a series of coordinated and interdisciplinary actions, an investment in time, which starting from consolidated reference models, can enhance local excellence. The overall strat-

egy may allow the rediscovery of this heritage of identity, oriented on the one hand, towards the maintenance of architectural elements and material-structural components; on the other, to make the existence of such architecture compatible with the new environmental requirements, in order to incorporate every useful innovation to ensure its function in a renewed circuit of interest. This, above all, considering the city's involution process, which has been characterised by a strong de-industrialisation and is in search of a new identity and a new trajectory of development.

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The Industrial Heritage of the Papermaking in the Fabriano Area. Problems and hypothesis of a Landscape and Territorial Valorization

Francesco Chiapparino*, Andrea Galli**

☞ * Department of "Social and Economics Sciences",
Landscape Research Center-CIRP, Polytechnic University of Marche, ITALY
** Department of "Agricultural, Food and Environmental Sciences",
Landscape Research Center-CIRP, Polytechnic University of Marche, ITALY

✔ KEYWORDS: Industrial Heritage, Papermaking, Landscape, Rural Development

ABSTRACT

The article proposes the project of an Ecomuseum of Papermaking for the area of Fabriano, an industrial town of the Italian Apennine hit by the recent economic crisis and featured by a remarkable industrial heritage. Next to the testimonies the papermaking industry, the work suggests the enhancement of the whole vast environmental and cultural heritage of the area. It identifies the landscape and the related rural development as the main resource from which the recovery after the recent economic crisis can be promoted.

The know-how rooted into traditional landscape could be revitalized by means of smart approaches. New functions for neglected traditional rural landscapes could be promoted instead of mere recovery of old practices that have lost economic, cultural and social significance. This way local identity and the involvement of citizens in managing cultural and environmental resources of places will be boosted, according to ELC's principles. Furthermore, efforts to design contemporary landscape could grow up in order to overcome limits of passive conservation of the traditional landscapes. Finally, smart approaches also include implementation of ICTs in promoting knowledge and tourist attractiveness of cultural landscape.

Located in the rural area of the middle basin of Esino river, Fabriano is a small town which played a relevant role in the introduction of paper making in Italy and Europe, during the Middle Ages (XIIIth-XIVth c.). At the end of XVIIIth century Fabriano was seat of the important paper factory Miliani, that developed up today in one of the most important firms of the sector (today part of the Fedrigoni Group). Next to this experience, Fabriano and its surroundings took part in the intensive manufacturing growth of the "economic miracle" after World War II, with the affirmation of the Merloni group (household appliances), and the widespread industrialization, as well especially in mechanical engineering, at the end of the 20th century.

As consequence of this conspicuous industrial history, a lots of pre-industrial paper mills, industrial factories, machinery, waterpower infrastructures (channels, derivations, electrical plants), historical archives, have enriched the territory, which on the other hand preserved also the features of the low and middle mountain of this part of the Apennine and its rural environment. Nowadays the area suffering for heavy de-industrialization linked to 2007 crisis. An actual chance to tackle these difficulties could be the project "Ecomuseo della Carta", a kind of special museum "en plain-air" to be built by strong participative processes involving

Fig. 1. Fabriano surroundings

people and local enterprises. The pivot project consists in the full valorization of the remarkable industrial heritage, specially that connected to the paper making, for the which Fabriano is famous at national and international level. Existing structures (the Paper Museum, the Historical Archives Miliani, etc.) should be networked with other important testimonies of this industry spread throughout the city area and in a number of locations in the surroundings, as well as in the rest of the Marche region and outside of it.

The suggestion of an *Ecomuseo della Carta* is therefore a contribute to identify new perspectives for Fabriano alongside its manufacturing, partially declining, vocation. The idea is to valorize assets of the area, both in the economic sense, reinforcing its touristic appeal, and in a broader cultural and civic one, activating participatory processes in redefining – without disclaiming – the traditional industrial identity of the town. The proposal is to create an urban and rural diffuse industrial heritage museum, fitting out archeological industrial and exhibition sites, and sometime simply connecting and coordinating the ones already existing in a network, with the aim to illustrate and valorize the conspicuous testimonials of paper history in the town and its surroundings. In a deeper sense, the purpose is to use the thematic heritage of the paper as a key to the valorize also the rest of the very relevant artistic, cultural, naturalistic and landscape features of the area in order to promote processes of urban and rural development.

The paper heritage has in Fabriano and its neighborhood important testimonials, the main of which are:

Fig. 2. Fabriano surroundings

- The big *Cartiere Miliani Central Factory*, rebuilt at the end of the 19th century and today not in use, recovering old – and sometime ancient – papery machinery;
- The *Miliani Historical Archive*, containing a large amount of documents on the history of paper and the Miliani group from 18th century onwards, as well as wide collections of watermarks, watermarks models, technical drawings, instruments, etc.
- The *Fornari Paper Mill*, which is also a relevant industrial building, with ancient mill machinery.

All these sites belong to the Fedrigoni Group, the current owner of Miliani Firm, are located along the Giano River, which provided the waterpower of the plants, and could be included in a thematic itinerary, a sort of suburban paper route.

Further plants are in the neighborhood, in some cases converted to housing, in other to be investigated.

- The *Paper Museum*, in an old monastery of the town, with machinery, documentation, didactical laboratories (where the production cycle of the handicraft paper is reproduced), exhibitions, etc.
- Former *Technical School for Papermaking*, created in the 1950s in the town and containing, among others, a didactical laboratory for industrial paper, which could be converted to a small museum (functioning) factory, and a botanical garden of the trees for paper.

In the Fabriano neighborhood there are then at least two further villages with relevant testimonials of paper heritage:

- *Esanatoglia* (15 km), a picturesque mountain hamlet with at least two ancient paper mills (to be recovered) and their hydraulic infrastructures (weirs, channels, loading pools, etc.), together with an ancient leather factory
- *Pioraco* (34 km), where a further Miliani plant lies, with the old factory and a small paper museum

Wider paper itineraries can include more distant sites, like the Papal paper mills of Ascoli Piceno (of the 16th century), the paper district of the Menotre Valley, on the other side of the Apennines, in Umbria, or the Montefeltro Ducal paper mill of Fermignano, near Urbino.

Fig. 2. Fabriano surroundings

The preservation of the industrial memory should be connected to the valorization of both the relevant artistic and architectural heritage accumulated by Fabriano and its district over the centuries – from romanic art to baroque – and the significant naturalistic emergences of the area (Frasassi Caves, Gola della Rossa Park, etc.).
A further, crucial element of the project, moreover, is the rural landscape, which – given the context of a small center of the Apennine – includes all the above aspects and in which all are immersed. On this respect the project is to develop a network of greenways, routes, walks, trails that allow the fruition of natural and cultural values of the area. Alongside these conventional interventions, however, the idea is also to encourage the participation of local people and the involvement of the economic fabric, favoring the launch of business initiatives related to the tourist accommodation, the typicality, the agrifood and handicraft traditions. A further scope of action, finally, is to orient the conspicuous public funding to the rural mountain areas to productive towards activities integrated with previous and able to contribute positively to the conservation and improvement of the landscape.

In conclusion, the aim of the proposal is to foster a re-thinking on an effective strategy in boosting a local development sustainable, inclusive and participated, that combines the preservation of the local memory and identity with the landscape values of the territory in order to react to the present economic crisis.

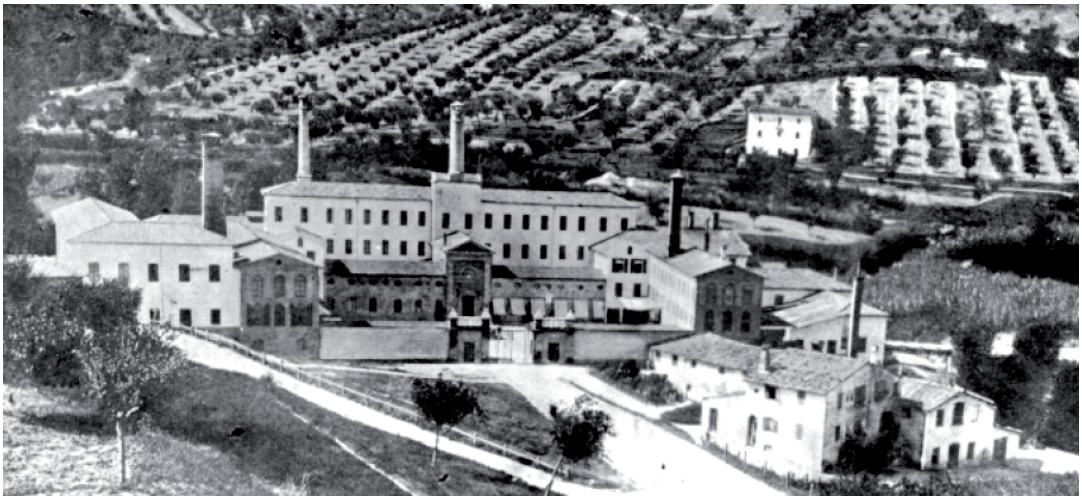

Fig. 3, 4 and 5. Miliani Paper Factory at the beginning of the XXth century and today (top left: the mallet battery of the old Fornari paper mill, today inside the Miliani factory area)

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Stuttgart Main Train Station by Paul Bonatz: a New Life For a Monument

Letizia Musaio Somma[a] *

[a] PhD student in Architecture, Cities and Landscapes: Architecture, Archaeology, Cultural Heritage, History and Resources DiCEM, Department of European Cultures and Mediterranean, University of Basilicata, Matera, Italy – (letiziamusaiosomma@libero.it)
* Corresponding author

KEYWORDS: Stuttgart, Paul Bonatz, infrastructural heritage, railway station, reuse

ABSTRACT

Stuttgart's main train station is an historical monument, it is a project by Paul Bonatz. The building has undergone deep transformation processes, both by Bonatz himself during the construction period (1914-28) and post-war reconstruction (1950-60), until the present partial demolition for modern high speed transport needs.

To get full knowledge of this monument, steps were taken to obtain the graphic reconstruction of the building, through available pictures and descriptions. All different configurations assumed in times were reproduced, both as a whole, both in the construction details, in order to recall its spaciousness and centrality in the urban context.

The work started by classifying original Bonatz drawings in historical phases, through the reconstruction of the parts not represented and the creation of a 3D model, analyzing the technological aspects, so leading to the complete reconstruction of the building during each historical period.

The memory of a building, as cultural heritage, should be perpetuated preserving the old function or giving it new ones, in this way subtracting from oblivion the building itself. Stuttgart railway station is not only a monument, but a symbol of the city as a modern "city gate" and territorial landmark.

Stuttgart's main train station is an historical monument, designed by German architect Paul Bonatz (1877-1956), professor of the Stuttgart School, in the early twentieth-century. The railroad system arrives in Stuttgart in 1846 (Bartl, 1990) and, on this occasion, the first station in the city was built. During the decades various transformations affect the infrastructure hub, up to the end of last millennium, which change the structure as a result of the new requirements related to high-speed rail transport. In this context, the railway building itself becomes the pivotal element of the transformation with the resulting change of its architectural, infrastructural and urban role. The work in progress of the new project provides input to retrieve the Bonatz building memory.

Stuttgart is the capital of the state of Baden-Württemberg and the understanding of the development of the railway network starts from the analysis of the road network in the region. The main roads form a ring around Stuttgart which is tangent to the limits of the region and links the five most important urban centers, they are connected with the capital by radial axes. The road network still maintains the structure given by the Romans, who, on those paths, created a series of villages and towns for the defense of the roads themselves. The rail system uses this pre-existing road network. In 1846, King William I of Württemberg, promoted the first rail line in the region, connecting Stuttgart and Ulm (Walz, 1980).

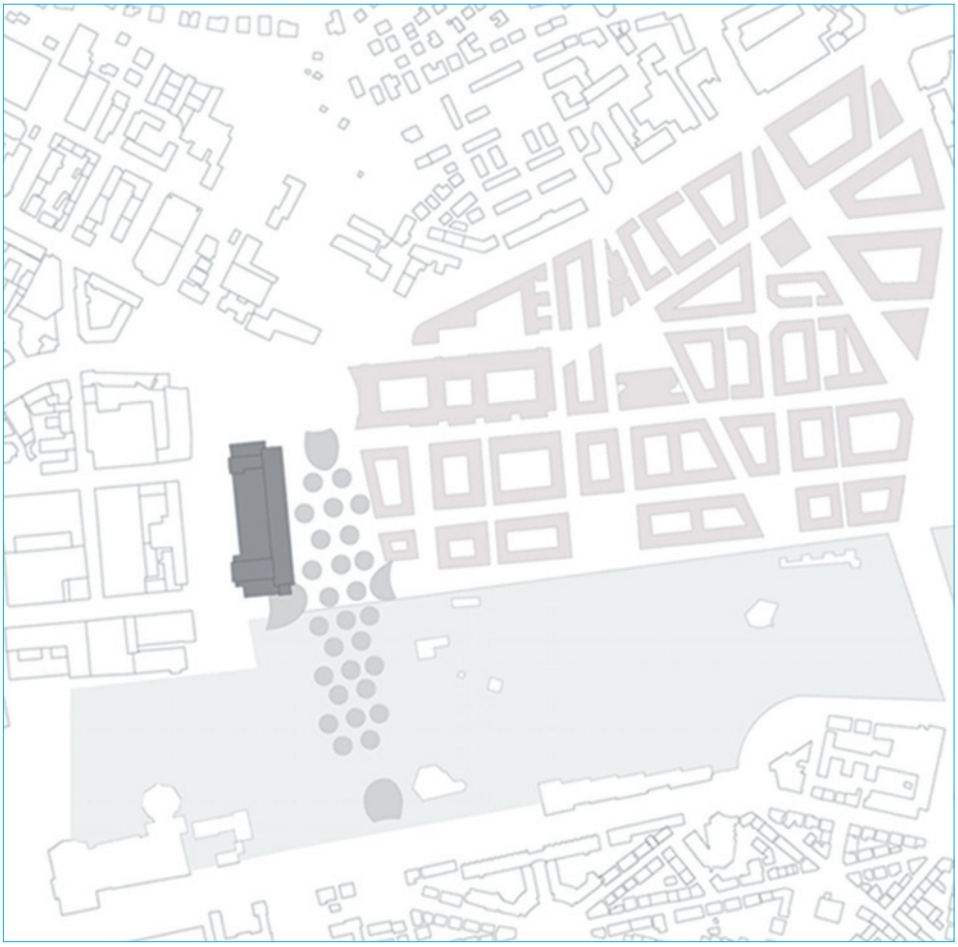

Fig. 1. Plan of the new project named "Stuttgart 21". Made by M. Balestra, M. Carbone, L. Fornarelli, F. Franciolapilla, L. Musaio Somma, A. R. Saponara, F. Strada

Stuttgart main train station was to be built in Cannstatt, the original Roman settlement, but, by means of a tunnel, it was possible to set it in the middle of the natural basin in which the city lies. Stuttgart, then, is at the center of the natural, road and rail systems: its central position and far from neighboring highlands, the proximity to Neckar river, as well as to Bad Cannstatt (Markelin, Müller 1991), a significant town in Roman times, allowed the city to assume an increasingly important role, although recently founded and became the fulcrum of the rail network. Nowadays, an important process of transformation is affecting the station area within the project "Stuttgart 21" (Roser, 2008), with the aim to adapt it to high-speed rail transport. The city is part of one of the "European corridors" of the TEN-T (Trans European Transport Networks) linking Paris with Bratislava and the conformation of its station, terminal station, does not favor the passage of the new high-speed trains. The project, under construction, considers the destruction of the existing rail beam and the realization of a new underground through station, twelve meters below the current one, with the rotated axis by 90° (Fig. 1).

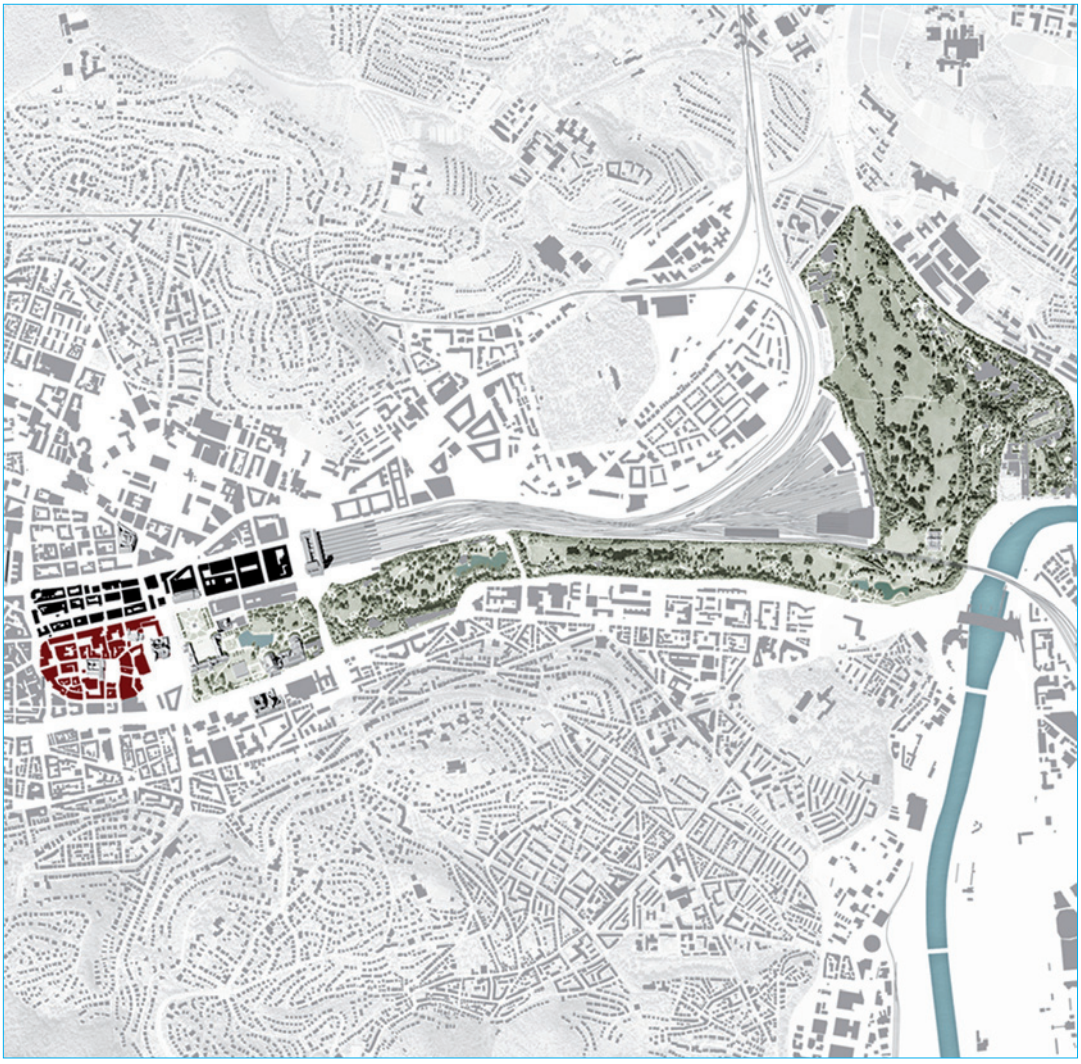

Fig. 2. Morphology of the city of Stuttgart. Made by M. Balestra, M. Carbone, L. Fornarelli, F. Franciolapilla, L. Musaio Somma, A. R. Saponara, F. Strada

Innovation works began in 2010 with the demolition of the two side wings of the historic building, causing an irretrievable "mutilation". Somebody thought of the risks arising that the station could lose functionality as such, since the projected underground station would perform all requested functions. In that way the new building would take those functions away from the historic station, as symbol of identity of a community and declared to be monument of significant cultural importance. The resulting disposal of the tracks produces the release of a vast area that is destined to a new housing development, extended to Rosenstein park. Similar events involve railway buildings of other German cities, such as Frankfurt and Ulm, affected by major changes today required by the adjustment of existing routes to high-speed rail transport. To this aim, the adopted solution consists in the reconstruction *ex novo* of the

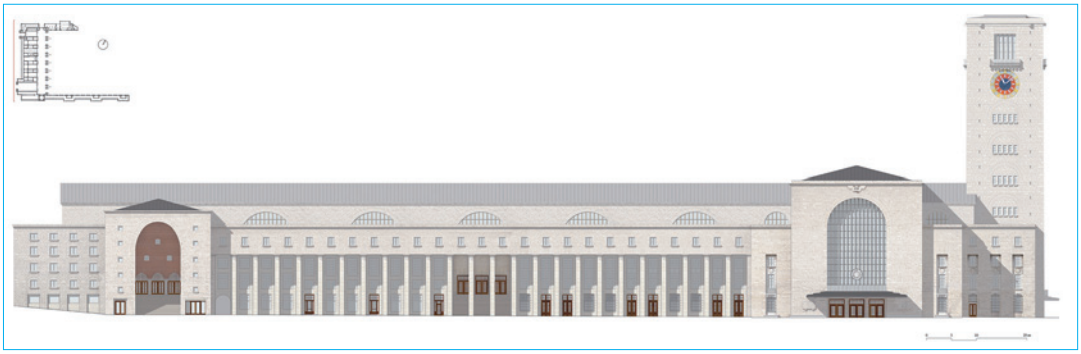

Fig. 3. South-west facade of the building at the time of the first version of the building (1928). Made by M. Balestra, M. Carbone, L. Fornarelli, F. Franciolapilla, L. Musaio Somma, A. R. Saponara, F. Strada

railway building, with the consequent creation of new urban districts. Because of the co-existence of the railway station by Bonatz (1910) next to the new one underground, Stuttgart would risk to be subjected to transform the first one into an empty shell.
In that case, in Stuttgart, an infrastructure hub of the German railway network loses its original function and changes its role in the urban and social context.
It is good to underline that the station by Paul Bonatz, in terms of identity, covers a central aspect linked to the proper role of the building in the urban context, as a modern "city gate" and landmark. The city of Stuttgart lays, in fact, in a natural basin surrounded by hills, having only one route of access in the direction NE-SW. Along this route the first railway tracks came running parallel to another strong natural element, the Schlossgarten, a linear urban park that stretches from the old town to the Neckar river (Fig. 2).
The entire area aspect will be lost with the construction of the new building, because it will interrupt the continuous natural system and the urban axis.
The strong urban value which we attribute to the building is found since the first planning project by Theodor Fischer in 1907, when he imagined the need of a street, Kaiserstraße, arriving in central position with respect to the façade of the new building (Bartl, 1990).
The architects Bonatz and Scholer, winners of the competition to plan the building, change the characteristics of the previous plan by Fischer, tracing new paths. They remove buildings in a position opposite to the station and the path of the Kaiserstraße and create two new streets at the ending parts of the station. In the new project the new building face the roads, through the tower and the ticket halls (Fig. 3).
The need to preserve a common heritage, as identity symbol of a community was implemented by means of the drawing, the tool which Bonatz always taught. The drawing was meant not only as instrument of representation, but a way to reach the knowledge, according to the criteria of the Stuttgart School. Such need arises from the intent to identify the elements to be retained in the new urban context that is under construction, with the aim to keep alive the monument and the memory in its completeness.
Complex events have affected the building over a century: starting from the competition project (1910) to the first building (1914-28), we had the full destruction during the II World War

(1942-44), the following reconstruction (1950-57) using different technologies, until actual alterations in this century.
Historical researches were conducted about the building designed by Bonatz since the Eighties; in details Matthias Roser (Roser, 1987, 2008, 2010), considered the historical evolution, describing the building architectural details and highlighted both the original planning assumptions and the transformation of the architectural elements introduced during the construction.
A further contribution to appreciate works by Bonatz was given during the Frankfurt exhibition (2011) held at the Deutsches Architektur Museum (DAM) in Frankfurt, curated by Wolfgang Voigt and Roland May. For that occasion a catalog was published, Paul Bonatz 1877-1956 (Voigt, May, 2010), aimed to order and gather a large production.
Original manuscripts by Bonatz (Bonatz, 1931, 1950) are also available, in them he examines his own work and the context in which he acted.
The complete reconstruction of the building in its spatiality and materiality, for each of the historical phases we considered, is obtained by cataloging the original drawings found in the city archives, through the drawing and reconstruction of parts of which there is no more proof, which lead to develop original drawings (Fig. 4).

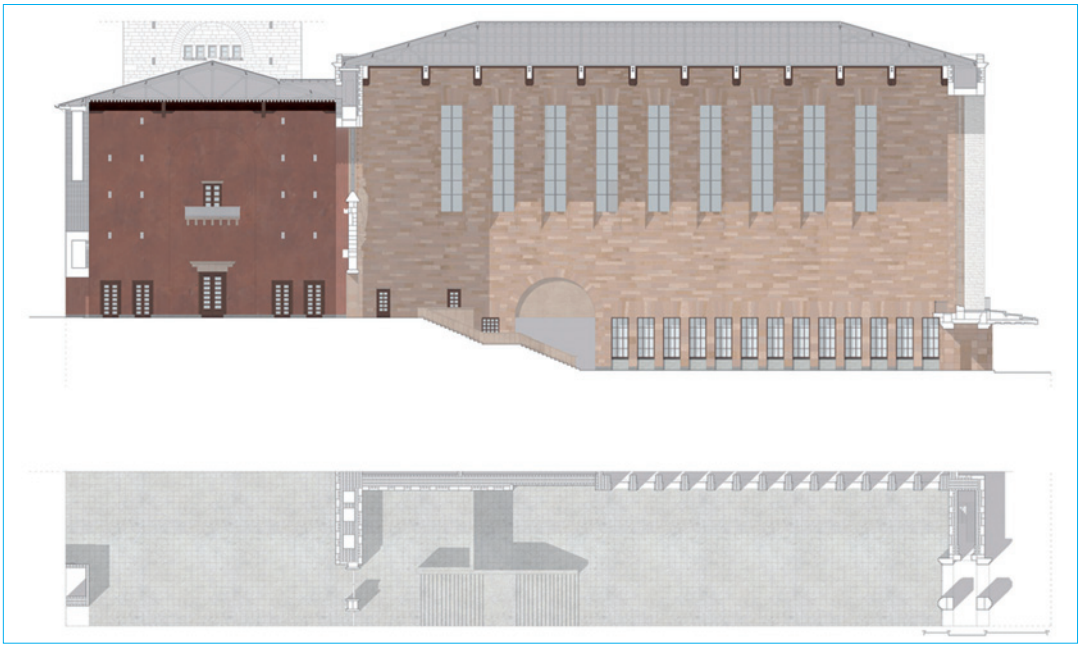

Fig. 4. Longitudinal section and plan of the small ticket hall (Kleine Schalterhalle) at the time of the first version of the building (1928). Made by M. Balestra, M. Carbone, L. Fornarelli, F. Franciolapilla, L. Musaio Somma, A. R. Saponara, F. Strada

The three-dimensional reconstruction of the entire railway station was added to the graphical representation, not only as volumes, but also from the constructive and technological point of view. The characteristic elements of the spaces, such as roof and construction details, have

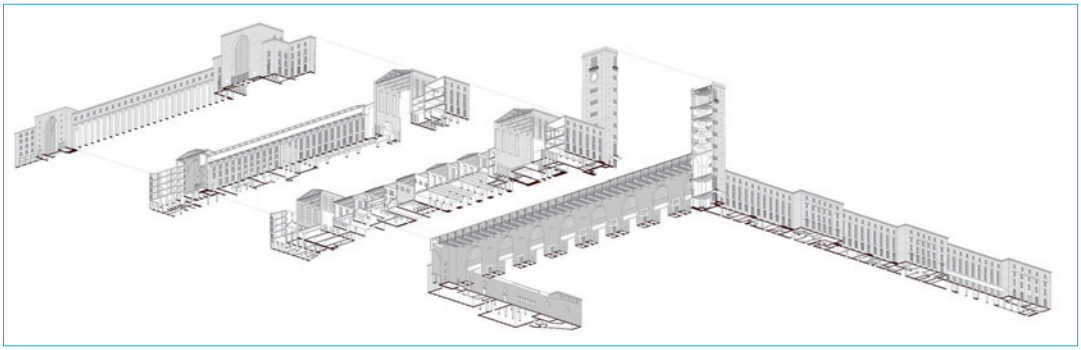

Fig. 5. Axonometric section of the railway building at the time of the first version of the building (1928). Made by M. Balestra, M. Carbone, L. Fornarelli, F. Franciolapilla, L. Musaio Somma, A. R. Saponara, F. Strada

prominence through the comparison of the two models, the first one reproducing the original building (1928) and the other one its later reconstruction (1960) (Fig. 5).

The aforementioned method of analysis according to historical periods was applied to the study of the urban area of Stuttgart station. The formation of the urban core in mutually dependant relationship with the routes, the cornerstones, existing monuments and public spaces, related to the railway building by Bonatz, was analyzed through the drawing by layer, on the basis of retrieved historical maps, for each defined period. The importance of the twentieth-century building in the popular awareness and in the European architectural vision requires that the building is enjoyed even after the construction of the new railway station, considering it not only as a transit hall, but with functions related to the railway field, like a ticket office and a waiting room. The three-dimensional reconstruction of the building as it appeared in historical and modern times, boosts the chances of preserving the memory of no more existing parts.

The historic memory can be conserved, for example, through the creation of a permanent exhibition of original drawings by Bonatz and photos that highlight the transformations of the building in relation to the urban context: this would be a good proof of new functions for an "archaeological" building linked to the transport system and in this way spreading the knowledge and preserving monument's memory.

Thus train station by Paul Bonatz can still be an important landmark in the city, retaining its function of "city gate", which today risks of being obscured by a new purely functional building. The study of the basic principles of the building and its relationship with the context allows to identify the architectural and spatial elements worth to be kept and maintained even during any transformations, we mean the respect of urban axes, the continuity of the linear park, the natural orientation of penetration into the valley, in order to give an idea of future development respectful of existing elements.

The research is the result of a Master's degree thesis in Architecture: "Stuttgart Main Station by Paul Bonatz: the urban building and the city"; A.Y. 2013/2014; supervisors: V. Ardito, L. Ficarelli; professors: F. Defilippis, F. Ruggiero; tutor: N. Panzini; graduates: Miriam Balestra, Micaela Carbone, Lucia Fornarelli, Federica Franciolapilla, Letizia Musaio Somma, Anna Roberta Saponara, Francesco Strada

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Industrial Archeology and Waldensian Valleys: Identity, Conservation and Enhancement of an Alpine Border Heritage

Riccardo Rudiero

☞ Politecnico di Torino – Department of Architecture and Design
riccardo.rudiero@polito.it

✔ KEYWORDS: industrial archaeology, industrial landscape, Waldensian Valleys, Chisone Valley.

ABSTRACT

The industrial and proto-industrial heritage of the Chisone, Germanasca and Pellice valleys, near the town of Pinerolo (TO) – known as the Waldensian Valleys for the large presence of the homonymous Evangelical Church – features important evidences that can be traced even at the Modern Age: milling, stone and metal extraction, and lately, linked to the production of yarn, cloths and mechanical activities, have bequeathed buildings and set of buildings of great relevance (also in state of ruin) and, in some cases, comparable with considerable international realities. The greater number of the valleys industries stood along the bed of the rivers and their tributaries, and, for the most part, ancillary works to plants (especially those of supply and use of water, from pipes to closings, supply reservoirs of hydroelectric power plants and distribution lines derived from them) are preserved with the built complex. This structured and ramified in the territory ensemble, having specific characteristics but collective roots, has been the subject of numerous studies of inventory and conservation proposals; these last in particular, have directly involved the local communities, who actively participate in the restoration and enhancement of their history, which identifies and intertwines with the testimony of industrial archeology. Moreover, recent and reliable studies have highlighted the close relationship between industrial activity and the presence of the Waldensian Church (in fact, many entrepreneurial families came from central Europe, and were of reformed religion), and the different approach towards work in factory than the Catholic community. This contribution is therefore intended to provide a reading of the industrial heritage tying him to the religious communities of the territory, to their fluctuating presence dependent on persecutions and periods of peace and coexistence, connecting the production complexes with works of charity and places of worship. At last, I would like to suggest a promotion connected with the roads and the international phenomenon of attesting of these industries, suggesting new conservation and advertising methods, aimed to a responsible tourism in larger scale, also availing of study cases examples.

1. Introduction

Pellice, Chisone and Germanasca alpine valleys, near the town of Pinerolo (TO), are commonly known as the Waldensian valleys. This strong semantic characterization highlights an important identity factor, detectable in the religious component: since late Medieval times the Valdes of Lyon message was professed in these valleys by the people. It still persists in a revised version after joining the Protestant Reformation (1532) (G. Merlo 1984, G. Tourn 2003). In compliance with the alpine culture and religious beliefs, the main activities were agriculture, livestock and manufacturing. These activities significantly changed with the advent

of industrialization (nineteenth century). For the abundance of water, the valleys were some of the first most industrialized areas of the Savoy state and we can notice this peculiarity in the wide network of material evidences, such as production complexes, social facilities built for the working class, water channeling, electrification system.

2. The industrial system of the Waldensian Valleys

The two aforementioned identity factors raise the question if there is a direct correlation between industrial development and the Waldensian community.
In the early decades of the XIX century the relationship with European reformed environments originated important international business initiatives in the valleys, because these territories were very suitable for planting new industrial structures. Recent studies (C. Bermond 2014, pp. 115-127) show that foreign investors, especially Germans and Swiss, were attracted to the Pinerolo Valleys for the possibility of access to new and promising markets, with the advantage of a lower cost of labor compared to their countries of origin. The advanced technology at their disposal – especially in an expanding sector such as cotton – also allowed them to establish advantageous joint ventures where more capital was invested by local entrepreneurs in change of the provision of machinery and the developed knowledge. But if these investors were active preferentially in the Pinerolo Valleys is not secondary their fideistic proximity: Calvinists or Lutherans the Germans and Swiss entrepreneurs and engineers, who interfaced with local Waldensian businessmen (C. Bermond 2014, p. 74). This is what happened for the cotton mill of Pralafera (1832) in Luserna San Giovanni (Val Pellice), established with substantial capital of the Waldensian Giuseppe Malan, or the Widemann cotton mill of San Germano Chisone, which takes its name from the Swiss Vittorio who acquired, in partnership with the Italian Carlo Simonetti, from the Mazzonis' family (1892). Another example is the "Jenny and Ganzoni sas" (later Abegg), Italo-Swiss initiative settled in Perosa Argentina. Almost similar dynamic involved the ex novo silk factory of Perosa Argentina, made by the French Benedetto Berthelot in 1870 and taken over in 1883 by the Gütermann German family.
It is therefore evident, especially for the cotton sector, the existence of a Pinerolo and, more generally, Piedmont network (think of the Leumann family) of the textile industry, that interlaced business and financial dimensions, family alliances (often reinforced by weddings), and religious identities (C. Bermond 2014, p. 121).
So, fideistic commonality is an important factor for the installation of new production sectors in the valleys. But it can be considered an element of identity for the Waldensian community? If the response seems positive for what concerns the ruling class, the consequences that industrialization had on the local population are quite different. In fact, it radically refuses factory work, because of its religious tradition, that was also endorsed by the preaching of the pastors. The Waldensian community preferred agricultural activities, which were in crisis. To overcome this problem the population began to emigrate, and this originated a dynamics of Catholic immigration that was used in industries (C. Bermond 2014, 131-144).

Fig. 1. The Gütermann silk factory of Perosa Argentina (Google maps).

Therefore, industries play a dichotomous role in the Waldensian identity, and this is also reflected in the recognition of the factories as Cultural Heritage by the specialized Office of the Waldensian Board: nowadays there are no productive buildings marked as "historical sites": in this category are included more atavistic monuments (D. Jalla 2009, D. Jalla 2010).
Nevertheless, the sensitivity for the historical and human events that distinguished the Waldensian Church has meant that it was the promoter on several occasions of the safeguard of the industrial identity of the Valleys. A striking example is the preservation of the archives of the Wiedmann factory in San Germano Chisone, now owned by the municipality, which was carried out thanks to its direct action. Furthermore, through one of the first actions to the enhance of the industrial heritage in Val Germanasca – the restoration of abandoned talc mine in Prali and "Scopriminiera" cultural activities – the Waldensian Church has contributed to the creation of an eco-museum which highlights, next to mining work and the valley's economy, even the life of the reformed communities (C. Ronchetta, M. Trisciuoglio 2008, p. 139).

3. Project proposals: the industrial sector for the conservation and enhancement of the Valleys' cultural heritage

About knowledge and protection of this Cultural Heritage, the studies that have regarded Pinerolo and its valleys were many and authoritative (A. Cerrato, C. Ronchetta 1996; A. Massarente, C. Ronchetta 2004, C. Ronchetta, M. Trisciuoglio 2008). They don't just brought the identification and cataloging of all production buildings, but also the proposal of a series of itineraries which highlighted their historical, environmental and physical values, with specific reference to their material culture. Unfortunately these studies appear now just as a repertoire because many of these complexes are gradually breaking down. This suggests that the documentary value of what remains begins to prevail over the analytical and practical aspect than initially informed this research. However, there are few initiatives aimed at their protection and enhancement.

Fig. 2. Educational activities in abandoned mines of Prali (www.ecomuseominiere.it/visite/scopriminiera/).

For example, we remember the aforementioned project "Ecomuseo delle miniere e della valle Germanasca" of Prali; the association "Ecomuseo delle attività industriali di Perosa Argentina e valli Chisone e Germanasca" of Perosa Argentina; the "Difiloinfilo" path, at Pomaretto and Perosa; The "Ski Rochon" Museum of San Germano Chisone, where a small section of it is devoted to the activities of the Widemann cotton mill; the "Museo della Storia della meccanica e del Cuscinetto" of Villar Perosa. The latter in particular is a highly distinctive and catalyst element of the whole Val Chisone: it is an expression of the entrepreneurial ability of the Agnelli family, which influenced the town and the whole valley up to Pinerolo through innumerable works and political action. The city government is currently preparing a memory circuit of this family through the systematization of their historical places, and the setting of a permanent exhibition entitled "l'Avvocato e la sua Valle" in the building called "Finestra sulle Valli".
However, despite the abundance of cultural value initiatives there is a disorganized global management of this industrial heritage, and from many quarters is invoked its systematization to give a turn at the cultural and tourist promotion of the Valleys.
To overcome this, recently the municipal administrations of lower Val Chisone and Val Germanasca, in synergy with associations and cultural institutions such as Italia Nostra, CeSMAP (Centro Studi e Museo d'Arte Preistorica) of Pinerolo and local museums, are developing a project proposal, both cultural and touristic, to promote knowledge, conservation and enhancement of this industrial heritage through systematizing productive complexes and networking them with other attractions (historical, artistic, naturalistic, etc...).

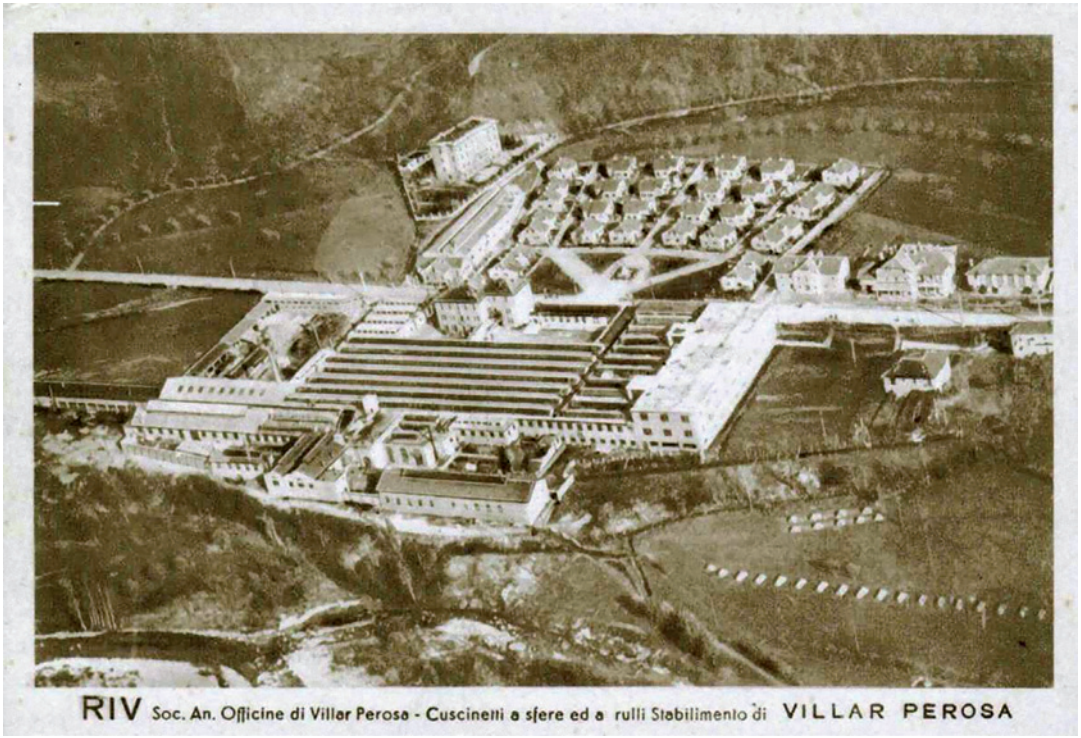

Fig. 3. The factory and residences system of the RIV of Villar Perosa, in a Twenties postcard (www.alpcub.com/tesi%20sandra/testo/cap%20IV/2%20la_riv.htm).

As first step each municipality must prepare a registry update of all industrial testimonies and an evaluation of the archives, after which it will move to the systematization of the existing initiatives in the area. Thanks to this preparatory phase it will be able to hypothesize enhancing actions for the industrial buildings through the inclusion of new functions into them. The systematization of the whole cultural heritage, where each site is considered not in isolation but as part of a complex environment, will avoid redundant initiatives and the fragmentation of the visits of the potential users. Having fulfilled this first phase, it will be necessary to assume a supra-municipal coordinate action, that should provide:

- the creation of one or more archives linked together and aimed at the preservation of factory and workers documents;
- the establishment of a permanent documentation and multi-disciplinary studies center;
- the preparation of a cultural communication through traditional and innovative channels.

In this regard it should propose:

- the creation of an internet site (a common platform) that funnel the information of every single industrial center of the valleys;
- the production of audiovisual material that can be used in museums or online;
- the creation of a tourist trail through the use of new technologies (QRcode, augmented reality, etc...), affordable to disabled people too.

The project idea designates as main stakeholder the inhabitants of the valleys. This would create a widespread museum that does not aim to the exclusive enhancement of material testimony, but also of the environment and local knowledge. Close attention will be given to students, in order to understand the natural and social environment, the industrial process and the substantial weight had on the landscape formation. The project envisages the establishment of a media and lower Val Chisone cultural pole, linked in particular to Gütermann and Widemann families and, above all, the Agnelli family, which constitutes a focal point with a large attractiveness. this system should be put in relation with Val Pellice's and Pinerolo's ones, with its industrial and proto-industrial system along the medieval flume Rio Moirano.
The project can be considered the stimulus for a territorial promotion on a larger scale. In fact, the industrial path can be the attraction pole for other itineraries (from the naturalistic to the prehistoric one) and the opportunity for the enhancement of the historic villages of the Valleys. Another important factor is that the Chisone Valley is an area of transit to and from France. It will be important to increase the use of alternative transport system, promoting a transnational soft mobility. In this sense, the short-term creation of the "Route Européenne d'Artagnan", the first European transnational riding trail (and that reaches Pinerolo), will certainly be an opportunity factor. Furthermore, the proximity to Turin and to the great ski resorts (as Sestriere), allow to have a very significant catchment area of visitors. In conclusion, this multidisciplinary context, in which the preservation of the culture, the direct population and students participation and the touristic activity are focal points of the project, may constitute a good opportunity to create new socio-economic development for the Valleys, indissolubly linked in a more conscious knowledge of the territory and its numerous resources.

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The Italian Grain Silos in The 1930S. Analysis, Conservation and Adaptive Reuse.

Stefania Landi

☞ DESTeC, Dept. of Energy, Systems, Territory and Building Engineering, School of Engineering, University of Pisa, Pisa, Italy – stefania.landi@ing.unipi.it

✔ KEYWORDS: Grain silos, Modern heritage, Concrete heritage, Adaptive reuse, Conservation.

ABSTRACT

This paper focuses on the grain silos built in Italy during the 1930s, when the so-called ammassi granari obbligatori (obligatory grain masses) were put into service under the pressure of autarchic Fascist policies. The silos network represents today a significant heritage that is largely unused and rarely object of attention. Since decades, many institutions have showed interest towards the unused industrial heritage, developing also remarkable preservation works. However, in Italy no one has ever focused the attention on this peculiar typology of structures considering them as a whole, despite their historical, technological and architectural values: this network, indeed, is not only a significant part of the Italian agricultural history, but includes also a number of remarkable examples in the use of the Rationalist language, and embodies the evolution of the building technologies that took place in the first decades of the 20th Century.

Therefore, starting from a comprehensive analysis of this network of silos, and taking into account the open challenges in the modern and industrial heritage preservation, the two main research objectives were identified: (1) providing guidelines for their physical conservation, focusing on historic concrete and glazing systems; (2) providing guidelines for their adaptive reuse, focusing on structural compatibility and identification of new uses. This paper aims to describe the research methodology that was defined to achieve these goals, and to present the main results.

1. History of the grain storage methods

The first step consisted in the analysis of the evolution of the grain storage methods over the centuries. The real turning point in this history was identified in the realization of the "Dart's elevator" in the port of Buffalo, around the mid of the 19th Century: a storage structure made of wooden rectangular bins, and endowed with a bucket conveyor, a steam engine and a rope-and-pulley power train, forming a mechanical apparatus that was able to raise the grain directly from the holds of ships to the top of the bins. In the following decades, different materials were experimented to build the bins of the grain elevators (from wood, to steel and bricks, to reinforced concrete) in order to improve their structural stability and to limit the risk of fire (Banham, 1986).

In Europe, the grain elevators (here called mostly "grain silos") were built in the main ports as well as along the main railway lines since the early 20th Century. A crucial role in the diffusion of concrete grain silos was played by the Hennebique Company (Fig. 1), whose patents were used also in Italy, i.e. in the silos of Genoa (1889-1901) and Cagliari (1904-1905).

This chronological reconstruction lead to highlight some fundamental common elements among all the grain storage facilities, regardless of the historic period or the geographical

location, namely, their nature of network and their strategic position in relation to the main sea routes and land routes: this is evident for the *Horrea* in the ancient Roman ports, for the Byzantines granaries along strategic military routes, for the medieval *grange* along the Via Francigena and, clearly also for the American grain elevators and the European grain silos.

Fig. 1. Grain Silos built by the Hennebique Company in Sidi Bel Abbes, Algeria; Edinburgh, Scotland; Dunston-on-Tyne, England. (Le Béton Armé n.178, 1913; Le Béton Armé n.125, 1908; Le Béton Armé n.150, 1910)

2. The Italian Grain Silos in the Thirties

Then, based on an in-depth analysis about the agricultural policies of Fascism (Vaquero Piñeiro, 2012), it was possible to address the characterization of the grain silos build during that period throughout the inland Italian territories.
First of all, it was possible to identify three main typologies: silos with vertical cells, silos with slabs and silos with hoppers (even if the two first typologies were the most widespread ones) (Fig.2). The silos with vertical cells in particular, were used for temporary storages, due to the higher speed in performing the uploading and downloading of grain; while, the silos with slabs were more suitable for long-time storages (around 7 or 8 months), thanks to the easiness in performing inspections and disinfections (Chapperon, 1936).
The silos construction was usually based on standardized projects, defined by the companies which provided the machineries. However, a local engineer was always called to develop the

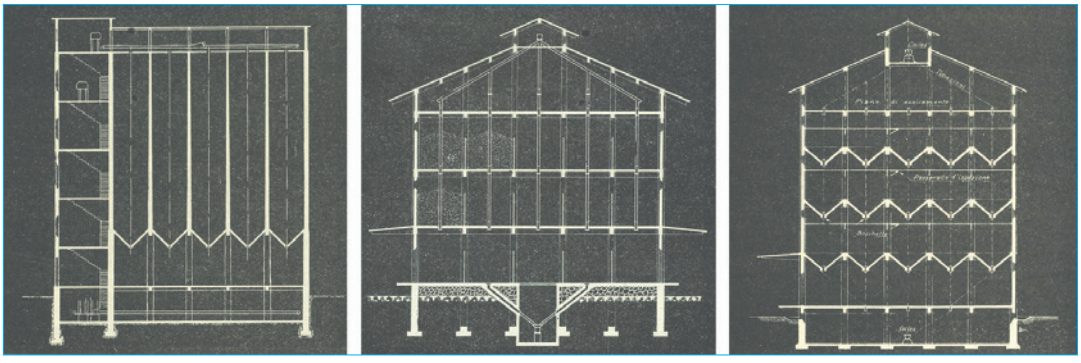

Fig. 2. Silos with vertical cells, silos with slabs, and silos with hoppers (Chapperon, R. 1936)

Fig. 3. Head of the elevator and horizontal conveyor at the top floor (Chapperon, 1936); Silos in Grosseto, hoppers and horizontal conveyor at the ground floor (photo: author)

design in detail, and to follow the construction phases. Moreover, especially in the most important centres, an architect was often called to design the envelope (i.e. silos in Rome by Tullio Passarelli). This combination of expertise resulted in many valuable industrial buildings, characterized by the most innovative technic solutions, and influenced by the coeval architectural culture.

As for the building technique, the silos were totally made of reinforced concrete, but in the silos with slabs, the perimeter walls may be made also by reinforced brick masonry (Garrè, 1935). As for the building layout and the machineries, the stair leading to the upper levels, was usually placed in the so-called "turret", together with the "elevator"; while the two "horizontal conveyors" were placed respectively at the top floor and at the ground floor (or at the basement level, when existing) (Fig.3).

As for the territorial location, the Italian grain silos (as their predecessors) were always placed in key positions according to the agricultural production areas and to the product distribution, therefore they were built close to the major roads and the railway lines.

The availability of considerable financial resources (in the form of mortgages issued by the Ministry of Agriculture to the local agricultural consortia) allowed the construction of hundreds of buildings (Fig.4).

3. The Mapping of the Italian grain silos

The mapping of the Italian grain silos, performed for the first time as part of this research, has been possible by combining information from manuals (Chapperon, 1936; Mariani, 1940), magazines (Azzini, 1936), archival documents and even historical postcards. It is important to point out, however, that due to the fragmentation of the original documentation, the mapping is still in progress (to date, an overall map or list of the silos built during the Fascist period has not yet been found). A general overview about the number of facilities was inferable

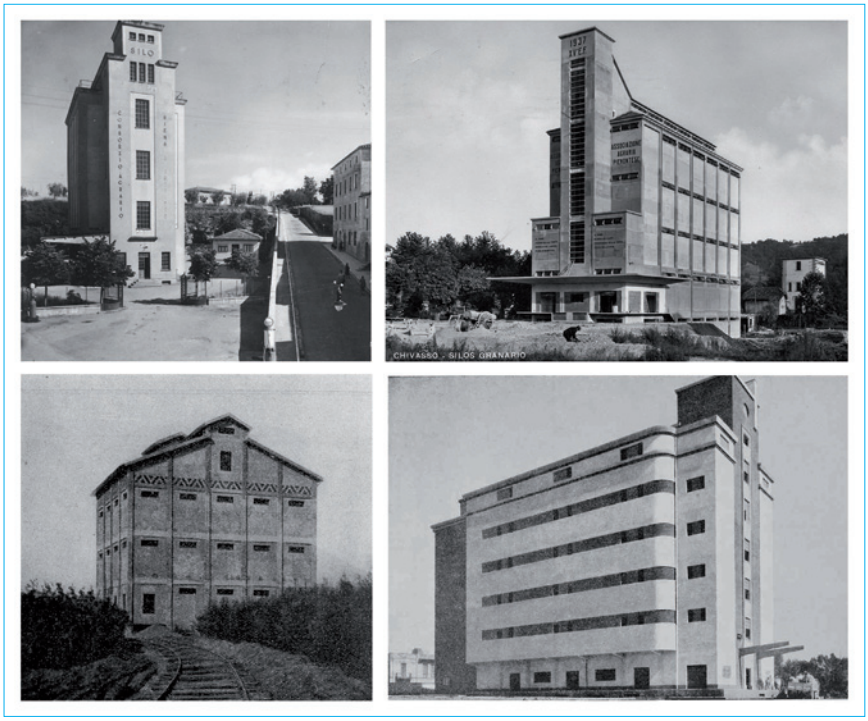

Fig. 4. Silos in Asciano di Siena (postcard); Chivasso (postcard); Pieve di Cento (Chapperon, 1936); Cagliari (Federconsorzi, 1953)

thanks to a map provided by the Federconsorzi (Federconsorzi, 1953), showing the numbers of grain storage facilities (province-by-province) in the early 1950s: those values however may be unreliable, because they include also the traditional warehouses, and refer to many years later the period of interest.
The number of silos identified through the aforementioned sources is 71, of which 23 (for the time being) were found to be still surviving. The distribution of the silos in the North, Centre and South of Italy plus Islands, is showed in the table below (Table 5).

4. Challenges in the conservation and adaptive reuse of the Italian grain silos

Regarding the physical conservation of these buildings, the main open challenges were found to be, as for the reinforced concrete, the invasiveness of the diagnostic techniques and the unsuitability of the industry-driven repair methods (Custance-Baker, Macdonald, 2014); while, as for the glazing systems, the main issue was found to be balancing the energy and safety requirements with the preservation of the building visual integrity (Nelissen, De Jonge, 2011). As for the adaptive reuse, instead, the main challenge was found to be the identification of new uses in relation to the structural and formal compatibility of the design solutions, and in relation to the short-term and long-term economic sustainability of the intervention.

Piedmont	Lombardy	Veneto	Friuli Venezia Giulia	Istria	NORTH	
Bra	Bergamo	Badia Polesine	Pordenone	Parenzo		
Carmagnola	Brescia I	San Donà di Piave	Latisana	Umago		
Novara	Brescia II	Venice	Cordovado			
Pinerolo	Corbetta					
Savigliano	Desio					
Saluzzo	Gaggiano					
Verolengo	Landriano					
Vigone I	Lodi					
Vigone II	Paullo					
Chivasso	Rovato					
	Sant'Angelo Lodigiano					
	Solaro					
	Voghera					
10	**13**	**3**	**3**	**2**	**31**	**TOT identified**
0	**6**	**0**	**1**	**0**	**7**	**TOT existing**

Emilia Romagna	Tuscany	Umbria	Marche	Lazio	CENTER	
Bondeno	Albinia	Città di Castello	Ascoli Piceno	Rome		
Budrio	Asciano di Siena	Urbino	Castel di Lama			
Castel San Pietro	Arezzo		Jesi			
Cesena	Castelfiorentino		Porto San Giorgio			
Ferrara	Borgo San Lorenzo		Porto d'Ascoli			
Medicina	Grosseto					
Piacenza	Prato					
Pieve di Cento	Saline di Volterra					
Rimini	Siena-Grosseto					
San Giorgio in Piano						
San Lazzaro di Savena						
Zola Pedrosa						
Fiorenzuola D'Arda						
13	**9**	**2**	**5**	**1**	**30**	**TOT identified**
3	**5**	**0**	**1**	**1**	**10**	**TOT existing**

Campania	Puglia	Sardegna	Sicily	SOUTH and ISLANDS	
Apice	Foggia	Arborea	Porto Empedocle		
Avellino	Gravina in Puglia	Cagliari			
Benevento					
Pesco Sannita					
San Bartolomeo in Galdo					
5	**2**	**2**	**1**	**10**	**TOT identified**
1	**2**	**2**	**1**	**6**	**TOT existing**

identified
existing
demolished

ITALY	
71	**TOT identified**
23	**TOT existing**

Table 5. Distribution of the Italian grain silos.

The identification of new uses for the grain silos, indeed, represents not only a complex technical challenge due to their highly function-specific layout, but also a complex decision problem because of the following reasons: the existence of many conflicting interests (public administrations, owners, real estate investors, inhabitants, etc.), the high variety of locations (from widely urbanized areas to mainly rural areas), and the deep differences among their territorial contexts (in terms of vocations and dynamics).

5. Addressing the Tuscan cases

All these challenges have been faced for two Tuscan case studies: the silos in Arezzo (AR) and the silos in Albinia (GR).
First of all, an overall analysis of the territorial context was developed, taking into account the natural and agricultural systems, the economic system, and the urban and infrastructural systems. The territorial analysis was followed by an in-depth study at the urban level, which provided the necessary information to hypothesize a set of suitable uses.
Then, for the case of Arezzo, the Multi Criteria Decision-Making Analysis was applied in order to rank different re-use options. This method implied the definition of: (1) the stakeholders, (2) some basic criteria (economic sustainability, structural and formal compatibility, reversibility, ability to meet social needs), (3) the design solutions corresponding to the aforementioned set of uses, and (4) the specific attributes aimed to evaluate the design solutions. Then, the different uses were ranked and the most preferred one was identified (Giuliani, 2016).
Instead, as for the silos in Albinia, a master plan for the grain silos and the surroundings lots was defined, and its economic sustainability was verified through the Discounted Cash Flow Analysis, a method which is applicable since the design phase and allows to analyse the costs of intervention, and the revenues deriving from the site management, in a defined period of time (Bertocchini, 2016).

6. Catalogue proposal for the Italian grain silos

The following step was the definition of a sheet, aimed to implement a national Catalogue of the Italian grain silos, which is expected to enable the national and regional governments to define the priorities of intervention.
Several existing sheets for the architectural heritage were analysed. At the national level, the most significant reference was the sheet defined by the Italian "ICCD Central Institute for Cataloguing and Documentation" (MiBACT); while, internationally, the most important reference was the sheet used in the "Docomomo Register", that is the widest database collecting information about the legacy of the Modern Movement.
At first, the catalogue was conceived to document the silos network and to develop comparative analysis, highlighting the common features as well as the peculiarities. However, during the analysis of the existing cataloguing systems, the importance of creating the sheet so as to comply to the existing catalogues became evident, in view of facilitating a transfer of information from the present research to the existing databases.
Then, the sheet was organized into four sections, whose main items and sub-items (to be compiled according to closed or open "vocabularies", or free text) are: (1) Identity: administrative localization, georeferencing, history of the building, national grid reference, legal status, urban context, territorial context. (2) Description: typology of silos; functioning; principal features (number of floors, number and dimensions of cells, etc.); constructive techniques

of foundations, walls, roof, staircase, shelter; decorative elements; doors and windows; peculiarities and values. (3) Current conditions: forms, extension and causes of the deterioration phenomena for each element defined in Section 2. (4) Documentation: photographic, graphic, textual and video documentation; principal publications and websites about the silos and its territorial context.

7. Guidelines for the conservation and adaptive reuse

The final step was the identification of guidelines for the silos conservation and adaptive reuse, whose main contents are summarized below:

1. Material conservation. As for the historic concrete, the attention was focused on innovative diagnostic techniques (i.e. micro-samples and multi-spectral image analysis) and on the implementation of case-specific repair materials. As for glazing systems, attention was focused on technical solutions able to preserve the silos visual integrity (i.e. replacement of window frames with custom-designed profiles, and selection of new glass panes on the basis of the characteristics of the original ones).

2. Structural compatibility. The attention was focused on: (1) structural survey, aimed to the comprehension of the structure's geometric configuration (2) structural modelling of the building both in the current and future configuration; (3) identification of possible local and global modifications.

3. Identification of new uses and Economic sustainability. It is suggested the development of territorial analysis, the application of the Multi Criteria Decision-Making Analysis and the Discounted Cash Flow Analysis.

4. General principles: (1) To promote the site's accessibility through private and public transport; (2) To provide multiple uses that, alternating over time, may keep alive the building continuously; (3) To promote forms of public-private partnerships; (4) To provide an ongoing participatory process since the beginning of the planning phase; (5) To provide a Marketing and Communication plan about the new uses; (6) To provide a Conservation and Management Plan, with instructions about the site's conservation and maintenance.

Conclusions

The identification of the reuse possibilities for the Italian grain silos is conceived not only as a design challenge related to the building itself, but rather, as an effort to give them a new role within their urban and territorial context. Therefore, this methodology is aimed to identify solutions for the conservation and adaptive reuse of the silos that are able to meet the needs of their context, while preserving their historical values.

This methodology is also expected to be extendable to other typologies of modern and industrial heritage, particularly if represented by networks of sites.

Moreover, a further development would be the implementation of a GIS map of the Italian silos, where the catalogue's data may be inserted and updated, becoming a precious tool to foster public and private subjects to develop regeneration projects.

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Heritage sustainable valorization and cultural districts

Places... Remain... Hidden...

Adriana Formato, Anna Paola Pugnaloni

☞ DICEA, Dept. of Civil and Building Engineering and Architecture, Polytechnic University of Marche, Ancona, Italy – (a.formato, a.p.pugnaloni)@univpm.it

✔ KEYWORDS: Flamina, roman bridges, hidden ruins, heritage, landscape

ABSTRACT:
A road from Rome to Fano, as far as Rimini: it is now almost impossible to understand its value; roads have been there since ever, they could be fastly rode by any conveyance… what kind of experience could be rediscovering that path, the ancient one, probably hidden and unobtainable?
to look for a very often disappeared path, sometimes underground, forgotten, encompassed by a landscape perhaps protective and compassionate, but still indifferent.
In sensational instances brown signs, the touristic ones, indicate something, a wall, a bridge, but nothing about why it was there and how, luckily, it is still there.
that need knowledge becomes a kind of story, something that we want to present with this paper, within the rediscover of that landscape that belongs to us and that needs attention to keep on telling stories.

> Will the people from the future believe in us when plants and flourishing fields would have covered those desert lands that are walking over what once were peoples and cities?
> *Publio Papinio Stazio, Roman Poet (Naples, 40-96)*

For the people from Marche region the Flaminia (Fig. 1) is the "Queen of the roads", among those "that bring to Rome".
Due to the secular heritage or, more probably, because of the Furlo Gorge, it is a typical trip destination during the childhood and a historic crucial joint: amazing landscape all around that lake, the path through the gallery, narrow rocky sky carved by the romans to cross the Appennini Mountains and get to the "other sea"… that is what we have been told. we could almost see people "pickaxe" that mountain that blocked their path.
A road from Rome to Fano, as far as rimini: it is now almost impossible to understand its value; roads have been there since ever, they could be fastly rode by any conveyance. what we nowadays call Via Flaminia, the state road 3 Flaminia, follows a different path from the original one that was designed for being the shortest and easiest one for the transport of the time. Through centuries, due to natural and antropic reasons, it has been modified, and greatest transformed, some parts are now a freeway. we now have two different "Flaminia": the original one, the subject of our research, is visible only in few parts, because of the ruins, sometimes charming, sometimes monumental, but usually hidden and hard to be found, that lie unknown

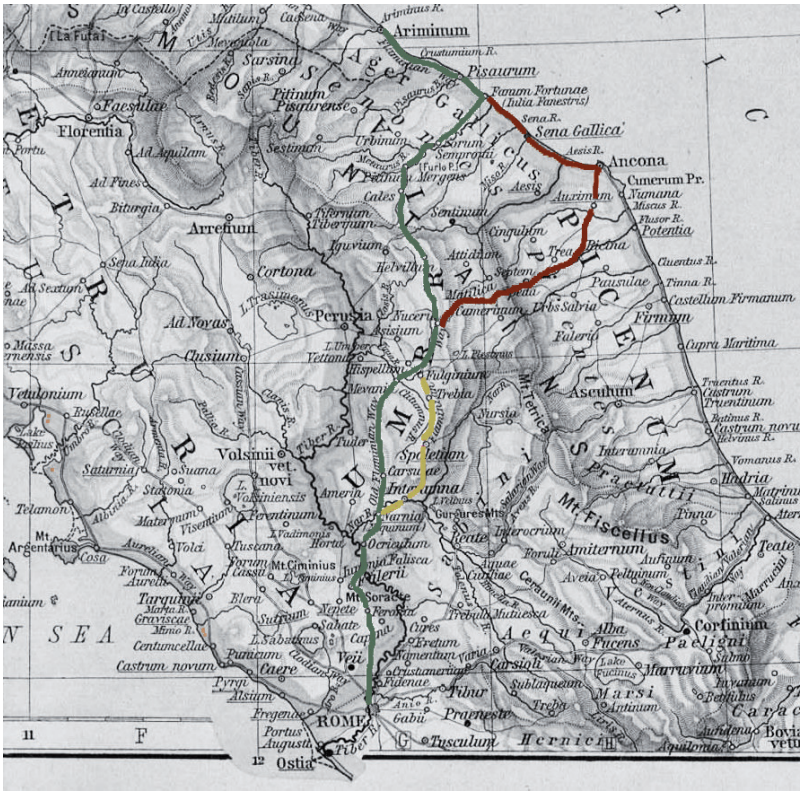

Fig. 1. Reconstruction of the trails of the Via Flaminia in its history (DICEA Archive)

even to people that live beside them. Few years ago we set up a little exhibition about the part of the "via Flaminia" that lies in the Marche Region. This sparked our curiosity and enthusiasm: since at that time the problem of the communication of the Flaminia was clear to us despite the knowledge of the ancient ruins.

The visibility of some sites, in fact, derived from a project dating back some years before and cared by the provincial administration of Pesaro and Urbino, which has led to the creation of some panels.
However most of them are not appropriate in terms of placement, readability and maintenance. Often hidden by vegetation, they are dimensionally inadequate, with faded photos and texts. They do not have a strong recognizability, or eye-catching graphics that would be helpful in driving the tourists or simple visitors in discovering not only that single element, but a cultural landscape and natural journey.
However, curiosity and enthusiasm were enough to go further and discover, also in Umbria and Lazio, that whole path that the Romans built to connect the two seas of Italy.
So let us begin this short trip on the freeway that reaches Narni, last bastion of the Roman road in Umbria, and begin to climb the stretch of the *Flaminia vetus*, leaving the *Flaminia nova* (the one that crosses Spoleto) for another journey… who knows…

It soon becomes clear that the pace of this research is going very slowly, GPS navigators can do nothing (being, this time, useless and ridiculous), we often, very often, must come back on our steps.
In fact, if we follow the old route we have to lean on a map, redesigned with difficulty, trying to combine ancient maps to more recent ones, the imagination to all scientific certainties (at that time prof. Luni was still alive).
In Sangemini we verify that the rest of the Roman tomb seen in pictures and that appeared similar to a large rock on the side of a road with an invisible indication, was really so, proving that even in this stretch, attention and regard are so weak.
The stop is short, we have not even met jets of water and laughing babies, like the memories of distant evoked advertisings. Carsulae miracle had already revealed earlier, but, again, it fails in belittling its charm and splendor to our eyes: it definitely deserves a descriptive stop, but luckily, it is still there, perfect and defined.
We are now interested in the Fonnaia Bridge, we are in the village of Massa Martana… Pre- vious experiences have taught us that asking directions to sparse loops is a useless enterprise: they are often wrong and difficult to be obtained, probably since our questions are full of technical terms: chiavicotti, viaducts, buildings… Unknown words, unfortunately. Somewhere a shepherd has fenced an area, or a farmer his field, or a private citizen has built the tower of his beautiful home, few centimeters far from an ancient substruction! (ignoring it, obviously). So we rely on our "poor" knowledge and on a sign, one of those that indicate monuments, the brown ones… Fonnaia Bridge on the left, Catacomb of Villa San Faustino on the right… going left we get lost in a not clearly identified place, no one is around… "U" turn: we take a path sur-rounded by beautiful nature of trees and hedges and finally a kiosk indicates Fonnaia Bridge and the Catacomb… They are in the same place then, why do they want us to come from opposite directions?… we're not gonna know, now… We use steps carved into the ground to descend into a lush cliff. A setting worthy of the best landscaper, that reminds Piranesi, with greenish re-flexes by a filtered light and the moss that covers it, powerful and beautiful. "… large travertine blocks perfectly squared and with rustication, it was built by the Romans in 220 BC and now it appears as after the Augustan restorations (27 d.C.). It allowed the Via Flaminia to cross the small tributary of Naia River and, so close to the bridge to the north, there are the sides of a chiavicotto with four rows of stones and a stretch of paving…" (Fig.2).
We remain in silent admiration having frenetic photographic sessions, pervaded by a subtle satisfaction and with a great desire to go and remove those stupid signs. "… In making that bridge the Romans builders did not economize: to cross what is now a trickle (but, at that time, probably, it was not so) they built a large overpass almost 15 meters wide and 9 meters long. With just 3,5 meters wide arch. Composed of impressive parapets and fences realized in large blocks of squared stone…" Thus, in our notes, we get to Devil's Bridge while we're mov-ing to Bev-agna, in the territory of Gualdo Cattaneo, paying attention not to miss the eventual presence of any faded sign: on the right an absurd tangle of reports on which, incredibly, even the object of our search appears.

Fig. 2. Ponte Fonnaia (DICEA Archive)

The road is unpaved presenting passing of lorries and ends after one hundred meters… no Roman ruins, but we're on the right way… halfway, retracing our steps through a large gate, we meet a glimpse of a deposit of building materials and we query a worker who is among bricks, benches, dust and lots of greenery: "…Yes, yes, there's something hereby. Please, enter car from the next gate…"
Accompanied by a long series of welded, rusty mesh, beside the border of the internal street we've been addressed to, we come to a strange mound of earth covered with vegetation: we catch a glimpse of an arch and big squared stones. Its majesty,obviously, has disappeared,it comes out from the ground not more than a meter, it is virtually impossible to take pictures of it… not even the Devil, whose name characterize the bridge (who knows why?…), could have stopped the neglect of the time: maybe just the vegetation tributes him a protective and compassionate attitude, but unfortunately, with indifference. (Fig.3).

Fig. 3. Ponte del Diavolo (DICEA Archive)

Passed Foligno we move towards Centesimo Bridge, unmistakable name. A railway crossing, over which the bridge of a freeway stands, stops us unwillingly… we look at a white sign on a light pole, which doesn't remind a sign of any kind at all, while on a country road, which is lost under the bridge with enormous pylons, a gentleman on an old motorcycle appears. He seems to immediately understand our urgency (we definitely appeared very picturesque and excited) and invites us to follow him.

That little road immediately becomes a lane, lined with beautiful olive and fruit trees… magically catapulted into a bucolic dimension we do not perceive to be still under the highway: nowadays its perception is completely lost.

The trail stops at a water course, a corner of incomprehensible peace and wonder: over the stream with clear water we perceive what remains of this bridge: a wall with the set of one of the original arches. Realized in opus quadratum of blocks of local stone, it has an irregular masonry, perhaps due to the different stages of restoration and maintenance (Fig.4).

The vegetation here has created wonderful architectures and the whole landscape is desperately trying to valorize it: probably because, on a closer observation, the place looks more like a small dump than the idyllic picture described so far. Our guide looks satisfied because he succeeded in pleasing us and, among imaginary elves and goblins, we go back with the intention of writing on that white sign that the bridge is under there… but it's too high, we can't get up there… so sorry.

Fig. 4. Pontecentesimo (DICEA Archive)

Marmoreo Bridge is at Nocera Umbra, or better in its territory. Nocera Scalo, for the sake of precision.

So, close to the train line Roma-Ancona, just under the actual Flaminia, at Fosso San Martino… very precise information, but which soon come out to be absolutely useless. We pass and pass again near the place, we stop, but then leave again without having achieved our goal. Our famous map is clear: it has to be there.

The umpteenth stop, always under the freeway that stands from a quite impressive height, we fearless head towards a sort of viewpoint that overlooks on anything or, at most, on a ditch, left to its fate since very long time.

Actually, a jungle stands there, a riot of plants perched all over that gently fall on this latest and Roman infrastructure, built in large blocks of travertine with a single arch, which probably owes its name to the marble decoration of its original railings (Fig.5).

Trying to reach it and taking photos is very difficult and dangerous, maybe it prefers to remain really hidden. The choice of these four bridges with dark and resonant names, of which now "just remains remain" is just symbolic, an excuse for a chronicle, a suggestion and, why not, a complaint. "A unique monument to be kept religiously untouched for its history and its legends, for its ruins and its trees, for the countryside and the landscape, for the view, the solitude, the silence, for its light, its sunrises and sunsets." That's the way Antonio Cederna use to define another consular road, the Appia that used to connect Roma to Brindisi… we believe those words stand also for the Flaminia although younger, despite half as long, although its

Fig. 5. Ponte Marmoreo (DICEA Archive)

territory is perhaps more respected and more anthropized, but still a track that is very often disappeared, sometimes underground, almost always forgotten, which needs to recover the "landscape of archeology", in a word, the knowledge.

Acknowledgments

On this trip we were accompanied, and not only, by:
Daniela Amadei, Luigi Sagone, Romina Nespeca, Gianni Plescia that we want to thank for their insight, daring, skill and tenacity.

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Atlas Of Re.cycle. A learning tool for abandoned cultural Heritage

A. Luigini*, C. Rizzi**

* Faculty of Education, Free University of Bozen
** Department of Civil, Environmental and Mechanical Engineering, University of Trento

KEYWORDS: Abandoned Heritage, Re.cycle, digital Atlas, social cartography

ABSTRACT

This contribution aims to develop a concept expressed in a recent paper presented at the international scientific conferences "Heritage urbanism" in Zagabria and "ReUso2015" in Valencia. Due to the large amount of neglected and abandoned buildings in Europe, the definition of heritage needs a new paradigm. The recycle of existing artifacts includes a new range of values that updates the typological, chronological and geographic extension of the notion of historical heritage proposed by Françoise Choay.

This update process defines a new theoretical and practical horizon that entails new categories of mapping and new approaches of evaluation and intervention.

The techno-ontological infrastructure that best works for this proposal is the Atlas: an "OpenStreetMap" based on ODC Open Database License (ODdL) and developed in a shared mode with social context. It can be seen not only as simple listing and geo-referencing of buildings or generally manufactured structure to "re.cycle", but as a real learning tool capable of organizing and categorizing the artifacts suitably.

Heritage in the Re.Cycle age

We are in the Re.cyle age. The topic of recycling is not a new one. The exhibition "Re-cycle; Strategies for architecture, the city and the planet" held at the MAXXI museum in Rome in 2011, presented important examples of new cycles of life for architectures and landscapes.
However, the innovative aspect emerged in the recent research program of national interest (PRIN) "Re-cycle Italy" is that recycling is a new paradigm and not a countermeasure in a particular contingency.
"Architecture and the city have always recycled themselves. Examples like Split, like the Theatre of Marcello in Rome or the Cathedral of Siracusa, just to mention three of the most obvious examples, are manifests of recycling. These are not restorations. The idea of preservation tends to embalm the image of architectural or urban space giving value to the immutable. The process of recycling changes its value when it manages to generate Fig.s as those in the aforementioned cases. The innovative aspect of the contemporary condition lays in considering this policy as strategic for the city, its architecture and derelict landscapes. The recycling paradigm is in contrast with the paradigms of new construction and demolition that have dominated the modern age, but not in a banal way. What interests us here is only observing the recycling experiences that produce culture, beauty and urban quality for the city." (Ricci M., 2012)
The key issues to understand this phenomenon are the large number of abandoned buildings and landscapes in the post-industrial territories and the new ecological consciousness.

Numbers | In one of his famous "Scritti Corsari" Pier Paolo Pasolini argues that in contemporary age the word 'development' is misunderstood as synonymous of progress. With the first term, he referred to the trend toward an increasing production of goods with the real benefit of a few, and with the second, the improvement of collective conditions of life.
Pasolini argues that development, welcomed by the mass as an opportunity of emancipation, was a bearer of new consumption values. After few decades, the effect of the ideology that Pasolini called the "blue-jeans Jesus", a kind of unconditional faith in the consumer product, are evident.
Buildings and infrastructures were considered as consumption products; environment, soil and landscape as unlimited resources. In Italy, from 1999 to 2009 approximately 300 million cubic meters per year were built. The data show that the national level of exploited soil has increased from 2.7% in the '50s to a 7.0% estimated for 2014, an increase of 4.3 percentage points. In absolute terms, it is estimated that the consumption of land has now affected some 21,000 square kilometres of our territory (ISPRA, 2015).
In 2013 about five millions vacant apartments or buildings were recorded, while in 2012 the cumulative Italian brownfields area was as big as the whole Umbria region (ISTAT).
Ecological consciousness | In the last decades ecology has become a central issue in architecture and urbanism debate. As C. Waldheim in one of his articles points out, the emerging of ecology in urban disciplines describes "the aspirations of an urban practice aware of environmental issues and imbued with the sensibilities associated with landscape." It "reveals the ongoing need for re-qualifying urban design as it attempts to describe the environmental, economic, and social conditions of the contemporary city." (Waldheim C., 2011) It is a radical change of approach where both specialists and society address the challenges of the future. Recycling as paradigm is a part of this change.
Heritage | Recycling means creating new values and new meanings (…) It's an ecological action that pushes what exists into the future by transforming waste into something that prominently stands out (Ricci M., 2012).
In this sense recycling as paradigm introduces a question about the issue of heritage. It undermines the traditional meaning of what is worth of being inherited. The 1989 marks the crisis of the monument. After the end of the Cold War the Iron Curtain was transformed: the void becomes a space to be indicated and transformed into an updated version of a monument.
According to Zygmunt Bauman, we can affirm that today monuments are as contingent, fragile and perishable as what they commemorate.

Atlas

The new meaning of heritage requires different tools and approaches. This update process defines a new theoretical and practical horizon that entails new categories of mapping and new approaches of evaluation and intervention. Atlas is not only a bound collection of maps, but also a volume of charts, graphs, or tables illustrating a subject. It is not a new tool, but

recent technologies and new social approaches based on sharing communities can help us to define a new kind of Atlas for recycling of existing heritage.
The recycle of existing heritage includes a new range of values that updates the typological, chronological and geographic extension of the notion of historical heritage proposed by Françoise Choay.
New collective values are non-utopian, conversational, and non-structuralist. They concern everyday, ordinary life and reality. A scenario determined by the fast challenges of last years – the effects of economic and ecological crisis, but also the great acceleration of innovation in Information and Communications Technology (ICT) – has transformed every citizen in a potential recycle cartographer and city maker.
Atlas can be considered sort of open-ended tool to test and to experiment a new form of urban renaissance based on a collective intelligence. The laboratory-city is the hypothesis of this experiment. "The cultural and tangible background of practices related to urban and architectural recycling as a response to the new economic and social scenarios and the urgent environmental needs regarding resource management, is now a laboratory where the new smartness of the city and of its communities informs the way advanced technologies and information are used, actions are carried out, and decisions are made in an *open* process" (Nava C., 2016)

Representation as knowledge tool: why social is better?

To arrange, to measure, to classify, are the actions of the construction of new alternative ways to simple list paratactic processes. The shift from quantitative listing to qualitative observation is made increasingly difficult by the overabundance of available information – both automatic or voluntary – and brings the need of critical data analysis tools to a level that was unimaginable only a few years ago.
The possibility expressed by the social cartography is a transition – mostly already started– that marks an era: the users' participation in the creation of the Atlas can be a carrier of the same elements of the social potential that later could become the totality of all consumers of the spaces resulting from the recycling processes. It constitutes a virtuous route that springs form participation to get to the social use of abandoned heritage, through innovative design visions, open to non-authorial forms of project. (Rykwert J., 2002)
A similar projection has been anticipated, in the first half of the '90s, by Mitchell, who in "The city of bits" wondered – and partially provided answers – about the role of the voyeurism/participation dichotomy, recognizing that the integration of the world of atoms and the world of bits precisely promotes this substantial shift between two approaches, between two "positions" towards the Reality by citizens (Mitchell W., 1995).
Since when urban space is also lived through mobile connectivity and geo-referencing of various social and relational information, it describes a very liquid geography, to decline Bauman's lucky metaphor, where the construction of the sense of place inevitably passes through the

complex system of relationships that the places are able to host, promote and increase (Gordon E. -de Souza A., 2011). And the citizen that passes by the sharing of emotions to share critical information makes social networks resilient: no longer users/actors of relationships between people in places but citizens/sensors capable of determining relationships between people and places. Some clarifying examples are related to emergencies caused by floods or earthquakes which, unfortunately, we often witness and where citizens/sensors have played a key role in mapping real-time status of the heritage, infrastructure and other citizens. Known to most are the Ligurian flood, the earthquake in Haiti or the tsunami in Japan that have worked as field of participative development of shared platforms.
The process depends, however, on the technological infrastructure in which the social meaning of this process is conFig.d: the current territorial representation instruments, clearly, allow a spreading and deepening of the previously described practices and open new scenarios compared to the previous local policies, isolated from overall general broader context.
The territorial description systems, based on the sharing of information (from Google Maps and OpenStreetMap to Crowdmap, Ushahidi and others) are open systems of voluntary mapping by citizens/sensors which take major benefits from the use of both input and output data: in getting to know and to use a space the user/sensor is brought naturally to become itself a resilient bearer of a shared know-how and, therefore, to establish an open relationship with the space itself and the perception of it by other users (Goodchild M., 2007).
Therefore, it goes from a system based on "expert knowledge" to a system based on "collective knowledge", in favour of the correct identification of project inputs and social issues. Thus, the project supported by a system of representation like that is aimed at a much more likely success, having the chance to mature on the input of users/sensors that later will be the users of reuse.
The proposed Atlas is not a mere collection of mappings, but it is a self-mapping system that the users themselves can trigger, defining the descriptions of the places to undergo processes of reuse, creating the relationships with the places both before and after the reuse actions.

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Scenarios For The Conservation and The Enhancement of Archaeological Heritage: a Gis Database For The *Gallia Narbonensis* Theatres

Alessandro Viva

☞ Student at the Scuola di Specializzazione in Beni Architettonici e del Paesaggio at Politecnico di Torino. Graduated in Architecture at Politecnico di Torino – alew91@live.it

✔ KEYWORDS: Conservation, Enhancement, Archaeology, GIS

ABSTRACT

This study, in a perspective of disclosure of research outcomes and of removing obstacles to knowledge, suggests some scenarios for the conservation and the enhancement through the design of a GIS database and a web-based platform.

This approach derives also from the verification that, until today, don't exist sources which provide a reliable geo-referenced location of roman theatres in France. The study, which has been carried out with the open-source software QuantumGIS, has been structured in three stages, to which corresponds an increasing in-depth analysis. At the conclusion of this study, a platform for the communication and divulgation of the outcomes has been proposed through a website, which has been conFig.d as a critical synthesis of the previous three phases. The GIS proved to be an instrument, which can be integrated into in all methodological phases of the archaeological investigation (FRANCOVICH R., 2000), from the "knowledge building site" to the science-based communication of the research findings, lending unity and coherence at all levels of intervention, from the territory (macro-level) to the single cultural good (micro-level).

Introduction

The experimental researches on the archaeological heritage have concerned, in recent years, more and more the development of innovation and the potential of information instruments. In particular, within the framework of the Disciplines, still young, of Digital Restoration and of Virtual Archaeology, (FORTE M., 1997) the use of Geographic Information Systems (GIS) appears to have taken prominence in the process of archiving, elaboration and integrated management of large quantities of geographical and spatial data (FRANCOVICH R., 2003).
Archaeology, as spatial discipline, represents one of the most suitable field for the transdisciplinary technologic experimentation: in the archaeological GIS project, the processing and interrogations on archaeological data deal with contemporary reality but also with possible tree-dimensional reconstruction or dynamic simulation of the ancient world.
In this regard the contextualization of the spatial information systems, incorporated in the digital ecosystem, makes the archaeological GIS an "hyper-informative" reality compared with the perceptible one (FORTE M., 2002).
The GIS interface allows, in fact, not only to visualize the archived data, codified in a single spatial system, but also to carry out an interrogation associating the relational database to the maps, according to multiple combinations, which may involve *records* also very different from each other.

The GIS database and the web-based platform of the French roman theatres

Every rigorous research, as it is well known, starts from the formulation of a pertinent question and it should add an innovative contribution to the body of existing sources through firstly a "theoretical-analytical" phase and successively a methodological-operative" one. The validity of such a research is even more demonstrated by the grade of its susceptibility to be used as a possible starting point of a more complex work.
The theoretical and methodological postulates on which the present study is based, have been established and developed with the purpose of outlining some possible scenarios for the material and virtual enhancement of the ancient roman theatres in France. In that case, the "theoretical-analytical" phase has consisted in a study on historical sources concerning the ancient Gaul. On the other hand, the "methodological-operative phase" has been conducted with both qualitative and quantitative research methods in order to enhance the Conservation issues with the benefits of modern digital instruments (VALENTI M., 1998). The methodology has envisaged an interdisciplinary approach which combined the Restoration procedures (interpretative hypotheses of the historical maps and iconography, verification of the "law of the persistence of the urban plan" dealing with the ancient theatres) with the Geographic Information Systems (GIS database) and also the modern communication tools (Website).

The approach, adopted in the thesis, has been multiscalar: starting from an analysis at a national level, the field of the research has been restricted and deepened progressively to a regional, urban and architectural scale.

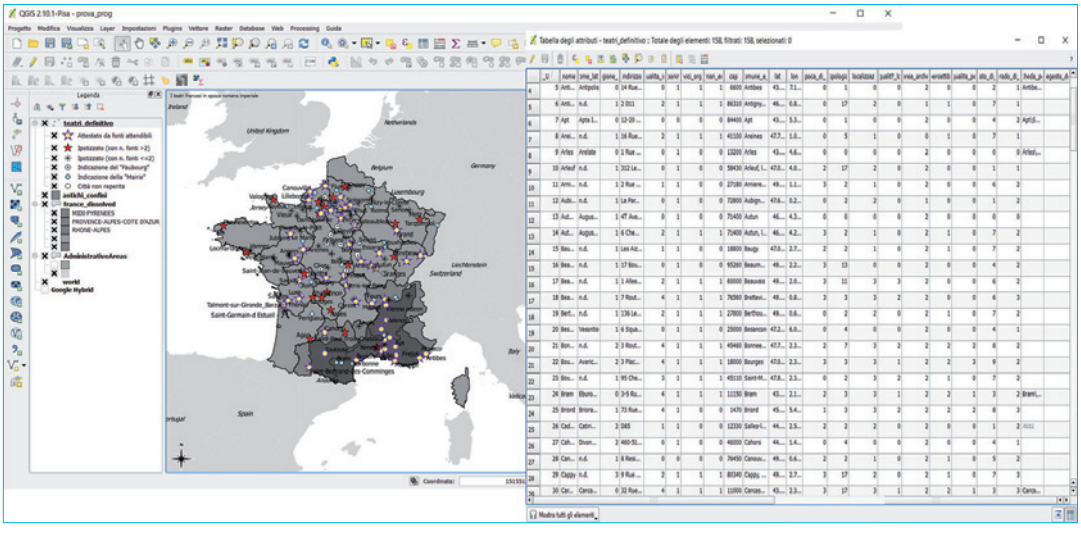

Fig. 1. The GIS database structured with the software QuantumGIS. Georeferentiation of the 158 ancient roman theatres (left). An extract of the table of records for the first 60 ancient theatres (right). Author's graphic elaboration

This should constitute the response to an enhancement strategy mapped out since the first stages of the Conservation process (ROMEO E., 2014). It also should encourage the divulgation and the removal of the barriers to knowledge for Cultural Heritage, as expressed in the Restoration International Charters, for instance the *Valletta Convention* and the *Losanna Charter*. Such a perspective seems to have been shared with regard to some interesting empirical applications, for instance, in the field of the *Digital Humanities* as well as in the European program *Horizon 2020*.

In particular, the "methodological-operative phase" has mainly concerned the design of a GIS database, achieved with the software *QuantumGIS,* in order to ensure a georeferenced, coordinated and continuously accessible management of the data collected during the initial phase. The database is structured in three sections: The first one, conducted at national level, has contemplated the totality of the 158 Gallo-Roman theatres, ensuring their georeferencing, flanked also by the storage of their information content (23 fields), inherent in "biographical" data (such as: period of construction, address, state of conservation, perceptibility, etc…) (Fig. 1). The second phase has involved, narrowing the scope of investigation, the 16 theatres of the Gallia Narbonensis, enabling the link function to an analytic schedule, containing not only the historical and basic information on the theatre but also the related historical iconographic and cartographic documentation. The third one has taken into account only the theatre of Arausio, Orange, through the reorganization and the storage of its documentation found (multimedia, literary, iconographic and cartographic sources) making even available a "regesto", indicating, for each document archived, the related bibliographical and website references.

Every single document has been digitalized in order to be easily displayed and accompanied by a link, whenever possible, to the website where the document has been found. For the theoretical personal interpretations on the data, in the "regesto" can be found the justification of the information provided by the author can be substantiated, showing the image or the photos of the single lines of the books that influenced the personal discernment.

Finally, in order to add a social value to the research results, has been designed a website for the divulgation of a "critical summary" of the main crucial outcomes. The online platform is the attempt to facilitate the reading and the fruition of the alphanumeric archives for the largest number of users, especially the citizens directly involved and interested in the conservation of this cultural heritage. Following these principles, the hypertext is characterized by a simple interface so as to allow the sharing, the dissemination of knowledge and a facilitated fruition of the data, enabling also the download of the *shape-file* (Fig. 2).

The website and the GIS database proved to be tools applicable in all methodological phases of the archaeological investigation, from the "construction site" of knowledge to the rigorous communication of the research results. These digital instruments confer unity to the totality of the intervention scales, from the territorial scale (macro-level) to the architectural one (micro-level) and can be integrated in the planning of national, regional and local conservation and enhancement policies.

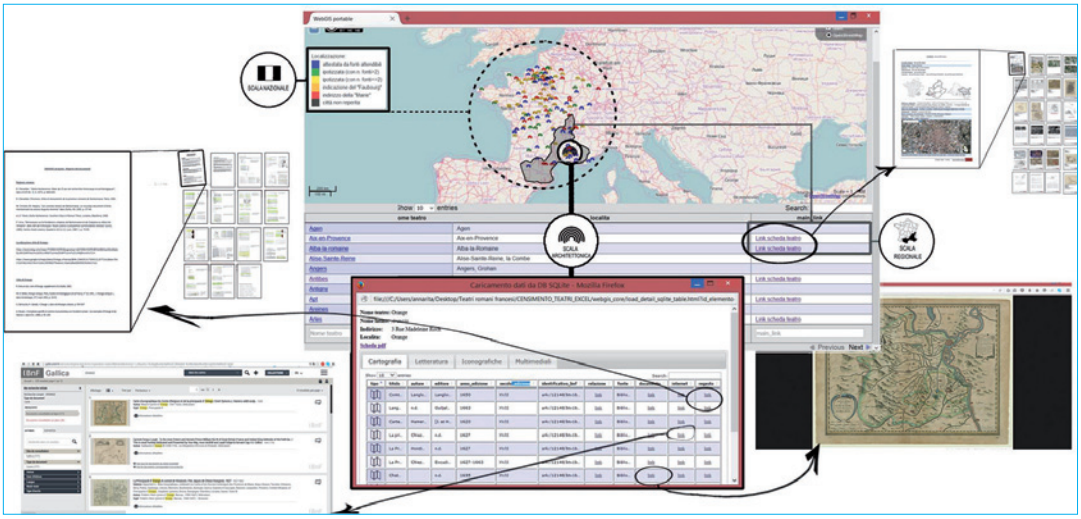

Fig. 2. Author's graphic elaboration representing the website interface (in the background), designed to summarize and communicate the outcomes of the thesis research. The black arrows make explicit the "link" functionalities enabled ("regesto", analytic schedule, reference to the website containing the document, the document visualized).

Implementation of an innovative approach for ancient French entertainment buildings

The research outcomes reflect a coherent intellectual reference and they are at the service of public and territorial authorities but also of single private citizens. This digital instruments if integrated in a planned Preventive Archaeology strategy, could constitute a benefit from the financial point of view. Just think for example the cultural and economic damage resulting from the premature interruption of building sites because of the discovery of archaeological rests during the execution of the works.

The present proposal starting from research outcomes aims to broad outline a framework dealing with a holistic approach open towards the different disciplines involved, mainly: Restoration, Archaeology, GIS Analysis, Survey, Web Design.

On this basis, the proposal concerns the conservation of ancient entertainment buildings (theatres, amphitheatres, circuses, stadiums) and the related enhancement policies, which should allow an efficient management of the data, facilitating also the direct participation of the researchers and web users to the conservation processes.

The choice of the entertainment buildings is related to the fact that, unlike other ancient roman buildings, for these architectures the original function (dramatic representation, urban festivals, concert etc.) can be restored sustainably, also from the economic point of view, in accordance with the requirements of the contemporary world.

Further economic benefits could result also from the "systematizing" the conservation and enhancement strategies. In fact, especially from the management point of view, the following scenario would lead to a continuous control of the amounts of data; fluid analysis of the field combinations with the related elaborations (graphs, statistics, tabs, counts); an "open" archi-

tecture of the digital database permitting a quick data insertion and an association between the relational database and the spatial data.
The proposal for the research project could be articulated as follows:
• Quantitative and, wherever possible, qualitative implementation of the existing GIS Archaeological Charter**s** dealing with the French archaeological patrimony also through some extensions of the database with some new *records* connected to the discipline of *Virtual Archaeology* and *Digital Restoration* (3D reconstructions, video, Augmented Reality) also using the modern survey techniques (LIDAR, Laser Scanner, Photogrammetry) (RINUADO F., 2013).
• Implementation of the website already designed by the author with the function of a forum online. This last should be a platform where the researchers could share and publish only original contribution, new discoveries, hypothesis substantiated by reliable (and viewable on the platform) sources. For example, an unreleased identification and localisation of latent buildings, namely ancient structures incorporated in later constructions or ancient edifices still under ground. However, in order to be considered really sustainable and functional, this process should establish an operative protocol in order to strictly regulate the access to the platform and the faculty of modifying the contents. This could be achieved through the resolution of a series of access levels, differentiated by the type of user and, therefore, competence permitting an efficient fruition of the online archive although sustaining the debate on the online forum through different interface and managerial scenarios (data *upload* process).
• Design and implementation of Applications for smartphones, which could strengthen the tourist offer and services, also using the modern technologies (such as QRcode, Augmented Reality, Virtual Reality) (TAMBORRINO R., 2015).

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Project Ager Mellariensis: Archaeology to Improve The Competitiveness of The Urban and Rural Areas of The Alto Guadiato (Córdoba-Spain)

Antonio Monterroso Checa[1], Francisca Vicente[2].
(Translation by María Aparicio Vicente. 4° Estudios Ingleses. University of Córdoba)

[1] Ramón y Cajal-MINECO Researcher. Dept. of Arts and Archaeology. University of Córdoba. Spain. amonterroso@uco.es Corresponding author.
[2] Manager of Local Action Group of Alto Guadiato. Fuente Obejuna. Córdoba. Spain, gerente@guadiato.com

KEYWORDS: Landscape, Archaeology, Remote Sensing, rural competitiveness, Mellaria, Alto Guadiato.

ABSTRACT
Archaeology can improve the competitiveness of rural and urban areas because History have the power of stimulate the feel of people with their past. That´s the main aim of Project Ager Mellariensis. Feel to know and develop. Feel and knowledge to improve the social and business capacities of the cultural heritage of the county of Alto Guadiato.
Our project aim monitoring the Landscape and study the principals sites on this county to improve tourist networks and elevate the relationship between the local habitants and their historical sites.

1. The ancient city of Mellaria.

Established in the LII mile of the Roman road from Córdoba to Augusta Emerita, Mellaria is the only Roman city that exists in the current administrative border between the Spanish regions of Andalusia and Extremadura (Fig. 1).

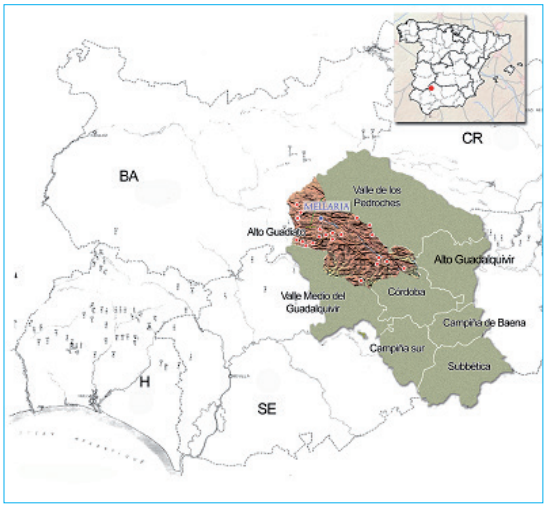

Fig. 1. Situation of Mellaria and Ager Mellariensis. Alto Guadiato-Córdoba-Spain (Composed by Giuseppe Palmieri for Project Ager Mellariensis).

In ancient times this territory was known as Beturia Turdula, according to Pliny the Elder (Plin., *Nat. Hist*, III., 13) and Strabo (Strab., *Geog*., III, 1, 6), and was a part of the great pre Roman region of Turdetania. This region, according to Strabo, was the most cultured and advanced area of all Iberia. Mellaria, which belonged to the jurisdiction of Córdoba, must have been a "nobilia" city, according to Pliny. It had a territory of more than 2000 km2, with very rich mineral deposits and agricultural environments. Mellaria had as nearby cities in the region of Beturia: Arsa, Mirobriga, Regina, Sosintigi and Sisapone.
Of Mellaria, until the beginning of this project, we only knew his location. Now, thanks to the activities of this project, we know perfectly his extension (Fig. 2).

Fig. 2. Ager Mellariensis. Archaeological site of the city of Mellaria. "Cerro Masatrigo" near Fuente Obejuna-Alto Guadiato (By Antonio Monterroso Checa for Project Ager Mellariensis. Founded by MINECO).

2. The current social situation of the region of Alto Guadiato.

The mining industrialization in the second half of the 19th century by French motivation, which lasted until a few years ago, was focused mostly on coal mining. Today there is no open mine and all the mining and metals industry has disappeared. The Alto Guadiato is one of the regions with a highest unemployment rate in Europe; especially young unemployment, which is needed to offer an appropriate qualification.
For too long it has been evading the wealth of this region. Private and public companies took advantage of it until total crisis entered and caused it disappearance. They left not training or

alternative. Changing the agricultural benefits of the land for the exploitment of coal, evading the control of their resources to private capital, neglecting self-development and lack of technical and technological training to develop, are the situations that are arising from this erroneous development strategy. Situations that today must being improved.
Consequently, the area has to reinvent itself completely and return to the surface of the earth. Therefore, smart specialization strategy integrated within the European Programme RIS3 by the Local Action Group of Alto Guadiato attends the *Dehesa*, i.e. the Environment. No coal again. Now this attends, as in ancient times, to the possibilities of exploitation of the land, their livestock, agriculture and river environment with new crops, new companies and new landscapes. Guadiato is slowly reborn, and there, in that intelligent use of the Environment, is where our Mellaria project is inserted; we want connect the heritage, scientific knowledge and cultural and tourist articulation within the "Dehesa".
It is therefore a socio-estate project to face a human challenge: to help improve the social, entrepreneurial and educational situation of this region through its archaeological and natural heritage. Then, this project has a collaboration and effective transfer between a research centre and the productive sector through the activities developed by the University of Córdoba and the LAG of Alto Guadiato. We all understand the *ager Mellariensis* (Alto Guadiato Córdoba) as a fundamental and strategic resource for the (new) region.
This social challenge requires multidisciplinary collaboration of various scientific and technological agents. What defines the actions to run is not, therefore, the sector or discipline in which the agents responsible for the execution are classified: is the social challenge of global improvement. Therefore, the ultimate goal of this project is to provide medium and long term obtaining social returns, including those resulting from the improved competitiveness of the productive fabric.
Identify the components of the Roman city and the rest of archaeological sites that exist in their environment is now essential. We use the most advance technologies in land, air and satellite remote sensing.

3. Some activities of our project

Mellaria is located in the middle of a beautiful field of hay, straw, and other similar crops that allow a good use of aerial photography to improve the structural knowledge of this roman city.
These surveys provide the use of systematic resources related to aerial photography. In a first stage, we took thermal captures with flights that cover one thousand hectares of land. At the same time, we were taking orthogonal photographs RGB. Both types of pictures were toked in different resolutions and conditions during the year 2013.
The last phase will be focus on a few selected sites using the possibilities of multispectral photography and IR photography captured by UAVs.
Airborne data acquisition (by Quantalab-IAS-CSIC, www.quantalab.ias.csic.es) campaign was

conducted with two sensors mounted simultaneous on board an aircraft (Cessna) flying at 250 m above ground level. The sensors implemented on board were:

- Thermal camera (FLIR SC655; FLIR Systems, Inc.) with a resolution of 640x480 pixels, is equipped with a 13.1-mm f1.3 lens and connected to a computer via USB2.0 protocol. The spectral response was in the range of 8–12 µm. The camera was calibrated in the laboratory (Quantalab; IAS-CSIC, Córdoba, Spain) to obtain radiance values. 5,133 images were acquired, covering an area of 2,350 hectares, divided into two zones 1,310 and 1,040 hectares respectively.

Ortho-rectification and imagery mosaicking were conducted applying Structure from Motion Methods (SfM) obtaining two thermal mosaics in Kelvin degrees with a spatial resolution of (0.37 m/pixel).

- RGB sensor (NIKON D800E). 3,473 images were acquired, covering an area of 2,350 hectares, divided into two zones 1,310 and 1,040 hectares respectively.

Ortho-rectification and imagery mosaicking were conducted as same as described in thermal mosaic, obtaining a very-high resolution ortho-photo and a digital surface model (DSM) with a spatial resolution of (0.036 m/pixel).

Znir Sensing Solutions (www.zetanir.com) developed images mosaic.

Fig. 3. Ager Mellariensis. Acropolis of Mellaria (Ortho-Photo RGB by Quantalab-CSIC and ZNIR for Project Ager Mellariensis. Founded by MINECO).

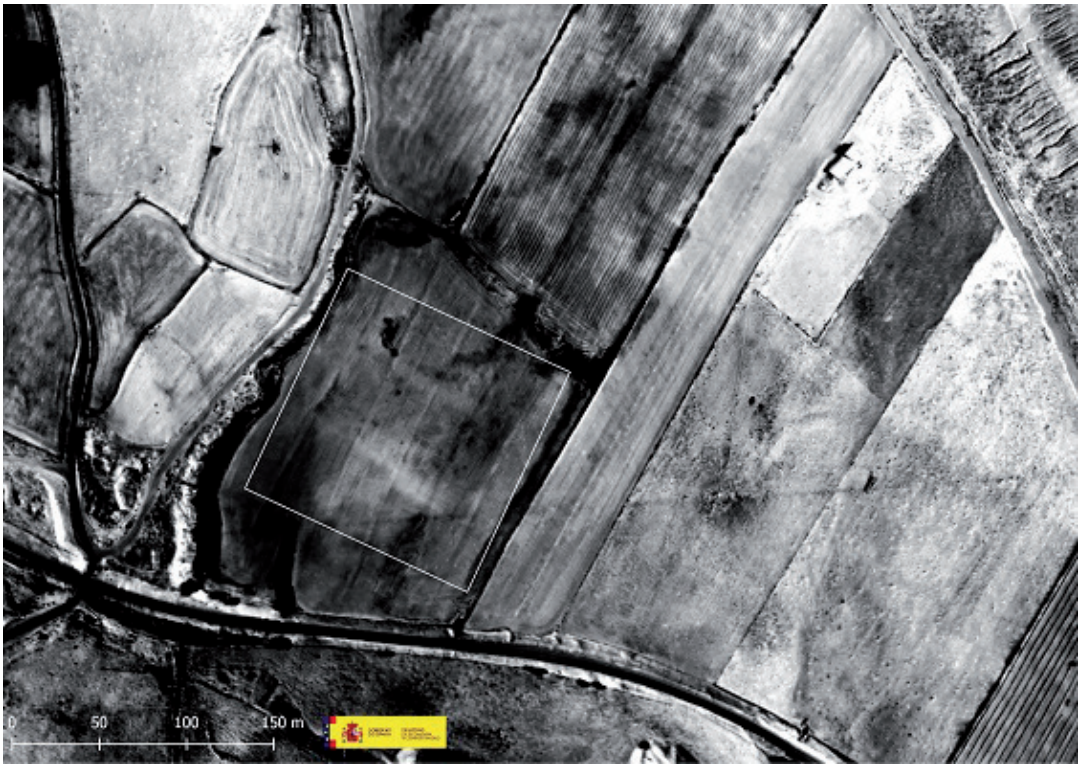

Fig. 4. Ager Mellariensis. Unknown archaeological site near Belmez-Alto Guadiato (Thermal Ortho-Photo by Quantalab-CSIC and ZNIR for Project Ager Mellariensis. Founded by MINECO).

These techniques, combined with traditional oblique photographs, allow us to have an accurate knowledge of the city that will be improve in two ways. On the one hand, for scientific explorations and, on the other hand, for the application of a future "smart archaeology" mixed with the design of a "smart landscape" concentrated around the city.

The results of the application of aerial photography have developed very much our knowledge in comparison with the input status.

As an example, we didn´t know the certain limits of the city two years ago, nor its connection with the ways of communications, water resources or the lead mining nearby, among other components.

Today, we have a design of activities and futures actions for this archaeological site and the rest of archaeological context situated in his historical landscape. Also for the middle Ages, we have developed aerial surveys and archaeological works in the other principal site on this county; the medieval castle of Belmez and his hinterland.

In Belmez also exists thirteen prehistoric monuments that will be integrated in our network.

Therefore, the exploitment of potentialities of the cultural heritage of Alto Guadiato cover then the Prehistoric ages, Antiquity and Middle Ages.

Fig. 5. Ager Mellariensis. Ancient settlement and medieval castle of Belmez-Alto Guadiato (Ortho-Photo RGB by Quantalab-CSIC and ZNIR for Project Ager Mellariensis. Founded by MINECO).

4. Objectives and expected results

For the field of natural heritage and archaeological and emergent heritage, it is necessary scientific knowledge and diagnosis of the preservation state, diseases and threats of the most significant milestones in terms of their potential for cultural and tourist landmarks exploitation.
For the field of competitiveness of crops located in archaeological sites, is intended performing dispersion maps and pathologies of each one of them with the intention of improving crop productivity at the level of small and medium entrepreneurs.
For the area of socialization and education, it is needed generating a platform with sufficient resources for small businesses, and organizations, so they could technologically develop this knowledge base through entrepreneurial activities and promotion.
Finally, for the area of improving the rural environment, we want a full analysis of the resources of the Landscape of Mellaria depending on the priorities of the "Dehesa" Ecosystem and for smart specialization strategy Developed by the LAG-Alto Guadiato.
This research and the generation of social structure, economic, cultural, and ultimately, productive, are anchored on two principles testable structure this project finally:
- National and international level and enable the first scientific progress research.

- Technological applications border and vanguard that make enable the development.
The ultimate aim, therefore, is to promote in a global and a comprehensive way, with all institutional, social and economic of the region agents, the research, development and innovation applied to the conservation and sustainability of an important artistic, natural, archaeological, historical and cultural heritage for the contribution to social and economic development of this territory.

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The Recovery of The Beauty of Minor Historical Centers
The Albergo Diffuso As A Means Of Reviving What Has Been Built

Brunella Canonaco*, Francesca Molezzi*

☞ * DINCI, Dept. of Civil and Building Engineering, University of Calabria, Arcavacata di Rende (CS), Italy – bruna.canonaco@unical.it, francescamolezzi@yahoo.it

✔ KEYWORDS: Conservation, building recovery, adaptive reuse.

ABSTRACT

This study examines new methods of valorization and revitalization of minor historical centers through innovative ways of touristic-territorial management and new project languages aiming to enhance the territory, identifying the model of the Albergo diffuso as a possible criteria of action to give new life to a territory.

Because of the complexity of the theme, the revitalization of little historical towns is at the center of a vast debate that involves different disciplines. This debate pinpoints around the discussion of the importance of the preservation and the necessity to redevelop these centers through innovative actions that consider more suitable functions for the urban fabric and the new tendencies of cultural tourism.

Since to preserve means first of all to be acquainted with something, all the analytical operations addressed to investigate the characters of a built environment become of great importance to define its history, its stages of generation, transformation and development. These operations become essential for the definition of both a protocol of intervention and a legislation that supports whoever wants to invest in this direction. The principal aim is to achieve interventions on ancient towns which contribute to their rebirth and use without damaging or cancelling the historical traces that lay in them.

The theme of the recovery and the revitalization of minor historical centers is the heart of a debate that involves many of the fields of scientific research.

Over the last fifty years, different ideas concerning the valorization of historic centers, have developed in varied theories that recently have produced the overcoming of the nominalistic definition of "*Historical Center*" changed into "*Old Town*" of consolidated and coherent fabric. (Properzi P., 2008).

Moreover, the complexity of this subject has provoked the elaboration of different classifications intended to analyze the problem in order to try to simplify it. In addition to this, further elements, such as economical and social aspects, have been included in the debate.

In a country like Italy, where each municipality has its own historical centers, it is essential to develop shared scenarios aiming at creating relations between the policies of public and private investments, intended to giving new uses and intervention methods on tissues and types of the historic city, based on a concept of conservation that is capable of interacting with other disciplines such as economics and social.

In this research work it has become necessary to approach the issue of the recovery of the smaller settlements to problems concerning environmental degradation often caused by the abandonment of historic villages. The reading of derelict built areas allows the intimate knowledge of the materials (Fig. 1), of the aggregative typologies (Fig. 2) and of the construc-

(left) Fig. 1. Exposed masonry of a medieval building (personal archive).
(right) Fig. 2. Aggregative typologies in a minor historical center (personal archive).

tive techniques facilitating productive understanding of a rural architecture with spontaneous character, of which is begun to warn the gradual disappearance.
We can look at these places as actual open air laboratories. It has to be clear that in bigger historic centers and in those close to streets, architectonic and environmental degradation shows several aspects: on one hand there is the progressive substitution of original architecture, sharing an intrinsic harmony, with totally incoherent buildings; on the other hand there is the unlimited proliferation of contemporary constructions, that rapidly engulf areas surrounding the elder nucleus, once made of fields and vegetable gardens. It is necessary to strongly recover these areas through an opposite architectonic approach.
This general phase of decadence seems to have found an opportunity of resumption today thanks to the diffusion of new sectors of economic development, above all those linked to tourism industry, that turn the minor historical centers into the protagonists of an original process of rebirth through the insertion of innovative formulas of diffused receptiveness.
A subject of great actuality in nowadays debate concerns the ways of intervention for the rehabilitation of the historic villages and the minor historical centers through innovative forms of diffused hospitality, which from the north to the south of Italy, represent a strategic model to pursue for a sustainable development of a territory (Tibaldi A., 2007).
Possible strategies of action are under development. According to these, it should be possible to preserve what has a historical relevance while favoring contemporary projects and promoting the reutilization of pre-existent spaces and buildings, often useless in devitalized

historic areas. The aim of these actions is the joining of past and present, paying attention to linguistic, technological and sustainable necessities.
The projects of diffused receptiveness, based on the concept of land area conceived as instrument for the growth of local resources, both material and immaterial, represent an extraordinary opportunity to valorize the identity of places and to guarantee the recovery of the architectural heritage and landscape patrimony of the historical settlements.
The structures forming the "family" of diffused hospitality (*residence diffuso*, *borgo albergo*, *paese albergo* e *Albergo diffuso*) are defined as *hospitable places*, for being deeply rooted in a territory and in its culture, and can be characterized by may different managerial formulas, all aiming to distress the themes of authenticity, experience, relationships and local development (Dall'Ara, 2005).
In the last few years the birth of a model of original hospitality *made in Italy*, that manages to be in line with the current needs of the tourists' demand, has internationally received a notable success, becoming a reference point for anyone involved in sustainable tourism development. In this context the innovative model of the *Albergo diffuso* begins to spread.
At present, in the scientific sector is becoming increasingly widespread the awareness that the Albergo diffuso, in addition to being a beacon of hospitality, is also a project of development of a territory, and from this point of view it can be defined as a *product of area*, or "*a flexible hospitable system, that has the objective to valorize the quality and the vocation of a territory, as also the power of attraction of a destination*". In fact, from a territorial point of view an Albergo diffuso is: an instrument of protection that animates a village or a historical center in state of semi-abandon; a model that infects the other forms of hospitality in the area which are invited to distribute the local traditions; a project that contributes to give spendable identity to places for tourists (Dall'Ara, 2005).
From the analysis on the national territory of the different typological, structural and managerial aspects, associated to the development of this new model of hospitality, has emerged that the evolution of the formula Albergo diffuso, in the near future could occur in two very different directions: a first one is represented by new forms of network, to create a system of tourism accommodations; the second one is constituted by the different themed declinations, which embody the typological variations of the original idea. It also emerged that it is possible to realize different typologies of Albergo diffuso, according to the variety of cultural and structural situations that a territory may present.
From a more structural point of view, in the carrying out pays particular attention to propose authenticity and originality, in aspects of both construction and the furniture, as well as in the search of a scheme to allow the guests to live the life and the traditions of the inhabitants of the place. The Albergo diffuso model cannot always be adapted to all realities or to every historical center, because of the presence of certain conditions and specific requirements. For this reason it is necessary to recognize a territory of reference, inside of which to seek the *tourist attractions*, aiming the attention at the possibility to exploit buildings and abandoned structures inside a historical center with tourist vocation. The concept of territory embraces all that stands on it, even if above the emergencies one assumes a prevailing role in compari-

Fig. 3. Valleys in the Alps of Friuli Venezia Giulia (personal archive).

son to the others. It is not the single element of attraction that characterizes the image of a place, but the delicate balance that is created among the elements able to convey a particular atmosphere (Fig.3). A sustainable development of tourism has to be founded on this principle and while complying the economic, social and aesthetical needs required by the travellers, it should try to preserve the cultural integrity and the fundamental equilibriums of the nature of a specific place. Conservation and renovation of small old towns through innovative forms of tourism based on the diffuse hospitality model, when matched by local development policies, can deliver economic growth in the short term and reduce depopulation.

The various forms of diffuse hospitality currently present in Italy have provided the opportunity to describe a growing phenomenon which allows to both revitalise old towns and increase tourism. Theories among the past five decades on how to bring new life to old towns, which have informed many conservation measures, are now shifting towards new models based on diffuse hospitality that, with the aim of boosting tourism, focus on plans and actions that make it possible to use these sites while being respectful of their historical heritage and surroundings.

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An example of Public Archaeology: the project "Progetto Montefeltro: atlante del paesaggio".

Strategic partnerships among local bodies to promote and protect the historical region of Montefeltro

Daniele Sacco*

* DISTUM School of History of Art, Medieval Archaeology, University of Urbino, Italy (daniele.sacco@uniurb.it)

KEYWORDS: Landscape archaeology, Public archaeology, Medieval archaeology, Montefeltro

ABSTRACT

Can archaeological research become a unifying element providing the basis for an integrated system of local bodies, with the aim to promote the area and increase tourism? Can archaeology increase tourist flows and generate tourism-related income?. Trying to answer these questions, a project was started in 2005, by the Teaching of Medieval Archaeology at the University of Urbino. The project could be defined as one of "Public Archaeology" and it was dubbed "Progetto Montefeltro – Atlante del paesaggio feretrano", to highlight the idea of an atlas of the region's landscapes.

Can archaeological research become a unifying element providing the basis for an integrated system of local bodies, with the aim to promote the area and increase tourism? Can archaeology increase tourist flows and generate tourism-related income? (McGimsey, 1972; Mannoni, 1994; Bonacchi, 2009).

Trying to answer these questions, a project was started in 2005, by the Teaching of Medieval Archaeology at the University of Urbino. The project could be defined as one of "Public Archaeology" (on the concept of public Archaeology see: Vannini 2011; Vannini, Nucciotti, Bonacchi, 2014; Nucciotti, De Falco, Lazzerini, Radziwilko, 2015) and it was dubbed "Progetto Montefeltro – Atlante del paesaggio feretrano", to highlight the idea of an atlas of the region's landscapes.

The historical region of Montefeltro lies in central Italy, scattered between the regions of Emilia-Romagna and Marche. The area saw the rise of the Villanovan civilization in Verucchio, the development of Roman *municipia*, the building of the castle of *Mons Fereter* in Late Antiquity (Sacco, Tosarelli 2016), the creation of the Diocese of Montefeltro and later of the Republic of San Marino, as well as the rise to power of the duchy of Urbino.

From a geomorphological point of view, the area borders the river Po Valley on the south, and features isolated rocky peaks and valleys eroded by the area's torrential rivers. This gives Montefeltro, especially the valley of the river Marecchia (whose mouth is right in the city of Rimini), an outlook that has always been considered especially picturesque.

The cities of Urbino and San Marino, both World Heritage Sites, are the area's major cultural-political outcomes, once part of the Duchy of Urbino. Two UNESCO sites are therefore at a short distance from one another, testifying of the richness of Montefeltro's cultural heritage: if we only consider the Middle Ages, it features about 200 castrensian settlements, 17 parish churches, as well as several monasteries, hospitals, mills etc.

The geographical area in which the "Duchy of Urbino" lies is located right in the hinterland of one of the busiest tourist regions in Europe: the "Adriatic Riviera." Despite this proximity, the hinterland was 'softly' considered, by the two regional governments, an added value from a tourist perspective. This is due, very likely, to the different way the coast and the hinterland are conceived (cost = fun / hinterland = culture, history). Moreover, between 2005 and 2006, nine municipalities of the area, at the time in the Province of Pesaro-Urbino, officially required to be annexed to the Province of Rimini. In 2009, following two referendums, seven municipalities officially seceded and were annexed to the Province of Rimini. This led to further fragmentation in advertising and promotion, also due to the parochialism of certain institutions. In this fragmented and somehow resentful – after secession – political context, the teaching of Medieval Archaeology of the University of Urbino decided to develop a project that, overcoming sectarianism, could investigate and promote the historical region of Montefeltro (Landscape as heritage Smith, Waterton 2009). The Municipality of Montecopiolo (Pesaro and Urbino) became the leading partner, having been the first to welcome the proposal to lead the way in this project. It was later joined by the Province of Pesaro-Urbino, which also became one of the project's funders, and by the Province of Rimini. Since 2006, the following bodies have joined the project:

- Marche Region: Province of Pesaro-Urbino (promoter); Archaeological Heritage Department of the Marche region; Municipality of Montecopiolo (leading partner); Municipalities of Carpegna; Montecerignone; Montegrimano Terme; Pietrarubbia; Belforte All'Isauro; Macerata Feltria; Regional Natural Park of Sasso Simone e Simoncello;
- Emilia Romagna Region: Province of Rimini, Local Department of Culture (also by means of sponsorship); Archaeological Heritage Department of the Emilia Romagna region; Department for Fine Arts and Landscape of the provinces of Ravenna, Cesena, Forlì and Rimini; Association for Historical Studies in Montefeltro; Municipality of Sant'Agata Feltria (leading partner); Municipalities of San Leo; Casteldelci; Pennabilli; Maiolo; Novafeltria.

This awareness raising action was not limited to public bodies: private organisations were also invited to take part in the project. Among theme is POMAL S.R.L. (owner: Sebastiano Bernacchioni), from Villagrande, Montecopiolo, which became one of the project promoters, by offering to the University of Urbino and the Municipality of Montecopiolo a former production site. The site hosts today a research centre whose aim is that of studying the Montefeltro area. This is a good example of public-private partnership.

Project Goals:

1. Mapping of archaeological sites and monuments in Montefeltro:
   - defensive systems;
   - places of worship;
   - inhabited settlements;
   - production systems;
   - road networks;

2. Area planning and protection:
   - exchanges with those in charge of the Archaeological Heritage Department and of the Department for Fine arts and Landscape, as well as with municipal technical offices in charge of protecting the territory from overbuilding and of town planning.
3. Archaeological Training:
   - training of students from national and international universities through the creation of Summer Schools on Archaeology.
4. Public Archaeology, dissemination of Montefeltro's cultural and landscape heritage:
   - organization of events such as conferences, seminars, exhibitions;
   - setting up of museums;
   - dissemination of research results through information technology;
   - promotion of the Montefeltro Project *through mass media*.
5. Participation of local tourist operators and qualified tourist guides:
   - interaction between archaeological research and tourism, achieved accommodating guests in historical buildings or farmhouses, all paying special attention to local culture, typical products and to environmental protection;
   - specific training of qualified tourist guides;

Goals achieved 2006-2016

Research centres
- In 2007, a detached research centre of the University of Urbino opened in Montecopiolo, with the task to manage the project and carry out archaeological surveys in the provinces of Pesaro-Urbino and Rimini. It features guestrooms for students participating in summer archaeological excavations, a warehouse for the storage of findings and several labs.

Archaeological sites
- The archaeological excavation site of the Castle of Montecopiolo, home to the counts of Montefeltro, then Dukes of Urbino, which opened in 2002, was further developed. Montecopiolo became the – guide site – for students of the Teaching of Medieval Archaeology;
- an excavation site was opened at the Castle of Faggiola Nuova, in Casteldelci (RN), birthplace to Commander Uguccione della Faggiola, a key representative of Italian Ghibellines;
- an excavation site was opened at the Castle of Bascio, in Pennabilli (RN), which boosts one of the most important towers in the historical region of Montefeltro.

Drafting of archaeological risk maps
- The mapping of archaeological heritage in the Municipality of Montecopiolo (PU), Sant'Agata Feltria (RN) and Casteldelci (RN) was completed.

Archaeological architecture surveys
- Surveys on the archaeology of buildings were conducted in several areas of Montefeltro, aimed at drafting an atlas of historical buildings. The most significant survey focused on the fortress of San Leo, the main tourist monument in the historical region.

Dissemination I:
Museum installations, exhibitions:

- an exhibition on landscape archaeology was set up in the City Museum of San Leo, June 26th, 2006 - September 3rd, 2006;
- the Archaeological Heritage Department of the Marche region, together with the Municipality of Montecopiolo, made sure, from 2011 onwards, that the archaeological site of the Castle of Montecopiolo, home to the Dukes of Urbino, was accessible to tourists;
- a permanent exhibition at the archaeological site of the Castle of Montecopiolo was set up in a public building;
- the Archaeological Museum "Uguccione Faggiola" in Casteldelci was renovated (Fig.1);

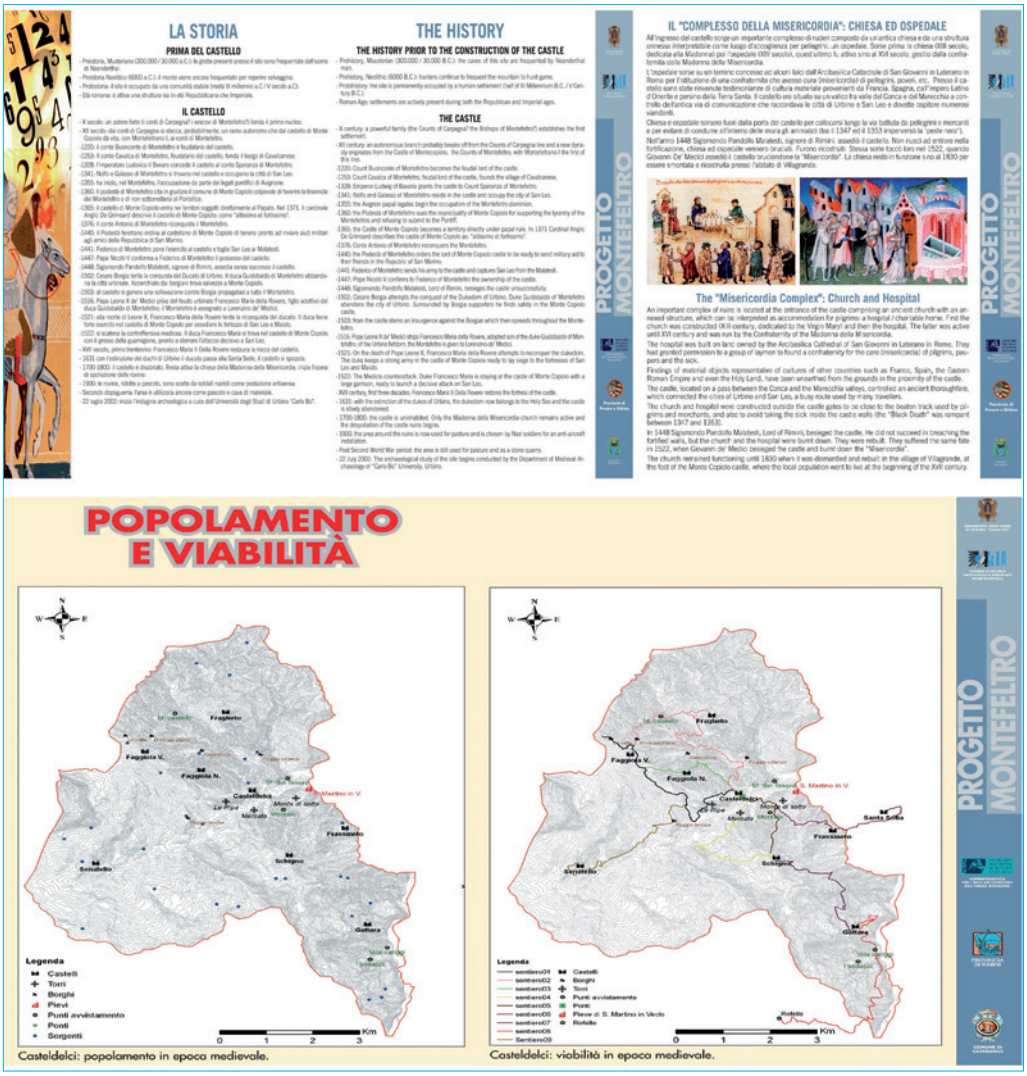

Fig. 1. Explanatory panels from the archaeological site of Montecopiolo and from the museum of Casteldelci (© University of Urbino, Medieval Archaeology).

Fig. 2. Examples of an illustrative brochure of the archaeological site of Monte Copiolo (© University of Urbino, Medieval Archaeology).

- following the indications of the Archaeological Heritage Department of Emilia Romagna, an exhibition was set up in Sant'Agata Feltria (RN), presenting the town landscape in relation to its population in the late Middle Ages.

Dissemination II:

Publishing of volumes / cultural outputs on paper and on-line:

- a volume on the excavations carried out at the Castle of Montecopiolo was published (Ermeti, Sacco, 2006);
- a book on the surveys on the archaeology of landscapes carried out in the Municipality of Casteldelci was published (Ermeti, Sacco, 2007);
- the catalogue of the museum "Uguccione della Faggiola" in Casteldelci was published (Sacco, 2010);
- a volume on the surveys at the fortress of San Leo was published (Sacco, Tosarelli 2016);
- assays on the area were published in local and national magazines;
- a guide to the archaeological site of the Castle of Montecopiolo was edited (Figg. 2-3);
- 40 explanatory panels for the archaeological site of Montecopiolo were created (Fig. 1);
- two Internet portals dedicated to surveys conducted in the Montefeltro area were created: www.archeologiamedievale/uniurb.it and www.castello.montecopiolo.com;

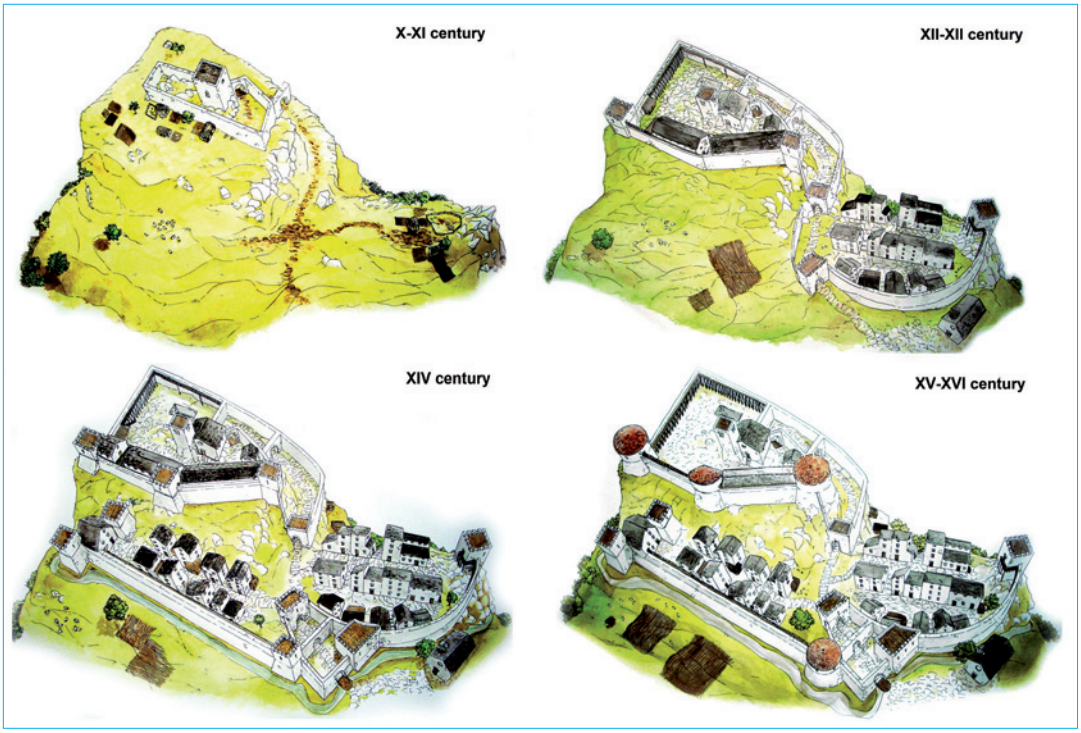

Fig. 3. Scientific diachronic reconstructions of the castle of Monte Copiolo (© University of Urbino, Medieval Archaeology).

- articles have been published in collaboration with the local editorial office of national newspaper "Il Resto del Carlino".

Dissemination III:

Seminars, courses, conferences, round tables:

- university courses on Montefeltro and its landscapes were held regularly, at the former Arts Faculty of the University of Urbino;
- conferences on the historical region of Montefeltro were periodically organized.

Dissemination IV:

Collaboration with local tourist operators and qualified tourist guides:

- archaeological workshops were organised in hospitality facilities, in order for tourist operators to better get to know the area;
- training courses for tourist guides were organised on site.

Advanced Training:

- since 2006 archaeological excavations at the castle of Montecopiolo have become international, thanks to the participation of students from the Complutense University of Madrid, the University of Liège, the Sorbonne University of Paris and the University of York.
- since 2015 excavations have been turned into an International Summer School, an advanced training course for students of archaeology from European Union countries, wishing to gain experience in Italy;

Fig. 4. the archaeological site of Monte Copiolo (© University of Urbino, Medieval Archaeology).

The project, which in 2007 won the Medieval Italy Prize as best "institution", has achieved tangible results, for increasing tourist flows and spatial awareness.
The archaeological site of the castle of Montecopiolo registered a satisfying number of visitors over summer months (Figg.4-5). Tourists were either staying for a few days in local hospitality facilities, or travelling from the coast for a day-trip.
Similar data can be obtained for the exhibition of Sant'Agata Feltria and the museum of Casteldelci, not exactly well connected to the main roads, which are now well known and can be visited with prior booking.
Statistics can also be inferred from the online portal of Medieval Archaeology, which has a very high ranking, being second on the search engine Google when typing: "medieval Archaeology" and "portal of medieval archaeology." Ever since the project started in 2006, downloads of topics relating to research and, in general, to the historical region of Montefeltro, have steadily increased. Downloads of public tools and material to better know the area (scientific and informative articles, etc.) have also risen. Tourist Information Offices in the two provinces have registered an increased demand for information on the Montefeltro area. The area visibility has objectively crossed national borders so much so that, in 2012, the German University of Freiburg contacted the University of Urbino to visit the archaeological site of the Castle of Montecopiolo.

Fig. 5. Military "Fama Leonis" encampment set up outside the walls of the archaeological site of Monte Copiolo, and a public-tourist event(© Fama Leonis / University of Urbino, Medieval Archaeology).

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"*Ritorno Ad Anxia*": From Digital Exhibition to Virtual Museum

Fabio Donnici[a]*, Antonio Pecci[b]

[a] Dottorato di Ricerca in Storia, Culture e Saperi dell'Europa Mediterranea, DiSU – Dipartimento di Scienze Umane,
Università degli Studi della Basilicata, via N. Sauro, 85 – 85100 Potenza (Italy) / fabio.donnici@unibas.it
[b] CNR – IBAM, Consiglio Nazionale delle Ricerche – Istituto per i Beni Archeologici e Monumentali, C.da Santa Loja – 85050 Tito Scalo (Potenza, Italy) / a.pecci@ibam.cnr.it
* Corresponding author

KEYWORDS: Anzi (PZ), digital exhibition, enhancement of archaeological heritage, innovative cultural experience

ABSTRACT

The purpose of the digital exhibition "Ritorno ad Anxia" (Anzi, Palazzo La Fenice, 11 August – 31 October 2015) was aimed at promoting the extraordinary archeological heritage of Anzi (PZ), a small village situated in the inner part of Basilicata, and making known the first results of the research project led by the University of Basilicata in its territory. It covered a selection of particularly significant finds for the reconstruction of local ancient history, which were accompanied by a didactic equipment based not only on traditional tools but also on modern digital technologies. The basic idea has been to involve visitors as much as possible in a stimulating cultural experience in agreement with the most innovative approaches to the communication of cultural heritage.

In this paper we present ideas, methods and technical aspects that have characterized this initiative – in many ways unique in Basilicata – of cultural development, even focusing on some solutions used along the tour route of the exhibition.

The next step of our project would be to create in loco a permanent virtual antiquarium, in which users can better appreciate not only new archaeological findings from recent researches but also, through the exhibition of 3D printed models, some of the most important ancient objects from Anzi, scattered during the 19th century all over the world.

Introduction

From 2014 the Classical Archeology Chair of the University of Basilicata, Dep. of Human Science, is leading a research project in Anzi (Potenza, Italy), a small village situated in the inner part of Basilicata whose territory had important settlement events throughout the antiquity, mainly between 7th and the 3th centuries B.C. (scientific direction: Prof. M.C. Monaco, with the collaboration of Dr.
F. Donnici).

The first results of this project, arising from both archaeological surveys and bibliographical and archival researches, have been presented in the exhibition "*Ritorno ad Anxia*" (Anzi, Palazzo La Fenice, 11 August - 31 October 2015). Its purpose was aimed at raising awareness and promoting the extraordinary archeological heritage of the area under investigation, not only

from a scientific and cultural point of view, but also as a valuable resource for a sustainable development (Fig. 1).

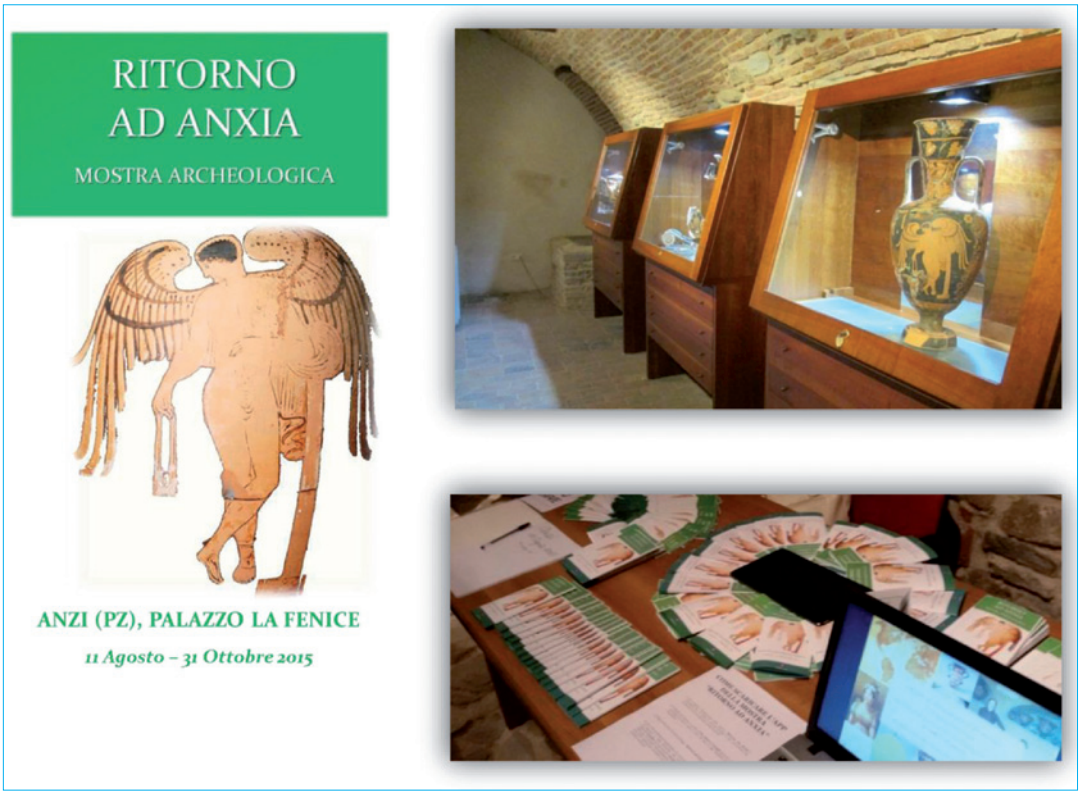

Fig. 1. Snapshot from the exhibition (photos: Authors)

The exhibition has been organized in close collaboration with the Culture Department of the Common of Anzi (Mrs. M. Fistetti) and the IBAM-CNR from Tito Scalo – Potenza, Italy (Scientific Supervision: Dr. N. Masini, with the collaboration of Dr. A. Pecci); it covered a selection of particularly significant finds for the reconstruction of local history, which were accompanied by a didactic equipment based on traditional tools (panels, captions, brochures) and on modern digital technologies (multimedia stations, video-animations, apps). The basic idea has been to involve visitors as much as possible in a stimulating cultural experience in agreement with the most innovative approaches to the communication of cultural heritage (Antinucci, 2014). In this paper we present ideas, methods and technical aspects that have characterized this initiative – in many ways unique in Basilicata – of cultural development, even focusing on some solutions used along the tour route of the exhibition.

The Multimedia Stations

The exhibition has been divided into three main sections, in which interactive multimedia

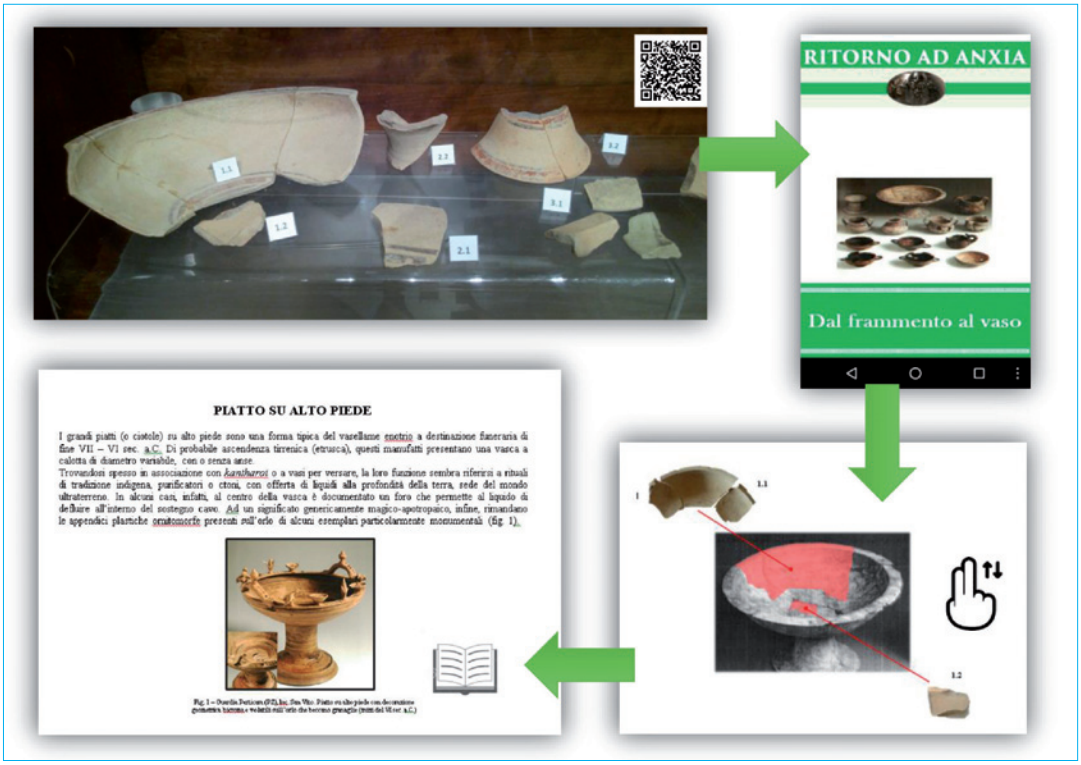

Fig. 2. Structure of the digital content "From the fragment to the vessel" (graphical elaboration: F. Donnici)

stations (tablets on totem) were installed in order to improve understanding of the materials on display. Characterized by stratified scientific contents, they have enabled visitors to create different tour route according to their own, more or less specialized, interests (Mandarano, 2009). The use of contents, weighted and subdivided according to the quantity and the typology of archaeological evidence to which they were related, has been mainly supported by *Qr Code* technology, already used in the field of cultural heritage (Bonacini, 2011).

In the first section about Archaic Age (8th – 5th centuries B.C.), a selection of pottery fragments was exposed. They belonged to vases of Oinotrian and Greek production, recovered in the territory during the surveys carried out by the University of Basilicata (2014-2015). Because those materials are, for the most part, exiguous and fragmentary, the aim of the digital contents proposed was to explain the meaning of the survey activity carried out by archeologists to identify ancient sites, but also the great importance that even the most exiguous material evidence could have for reconstructing the history of entire geographical areas. Particularly successful from a communicative point of view was the digital content entitled "*From the fragment to the vessel*", through which the users have been able to virtually reconstruct the shape of the vases to which each fragment belonged, and discover its own functions and meanings in Oinotrian culture (Fig. 2).

In the showcases of the section dedicated to the Lucanians (5th – 3th century B.C.), the largest one in the exhibition, groups of ancient materials were presented for the first time. These came from donations by citizens from Anzi, old excavations or new accidental finds, such as a red-

Fig.d Lucanian amphora, whose depiction was chosen as the iconic image for the exhibition. In this case, the number and the variety of the objects, all belonging to funerary offerings, made it possible to demonstrate, by means of specific digital focuses, many aspects of the society of the ancient Lucanians, its warlike ideology, its language and its artistic and handcrafted production.
In the Roman section (2th century – Late Roman Age) were gathered architectural and sculptural fragments found in the territory and now kept in the local church of S. Lucia. Here, in addition to the possibility to display the sheets of each find, has been provided an insight into the likely *statio* of *Anxia* along the *via Herculia* in the general framework of the Roman Lucania.

Looking for ancient finds from Anzi in the world museums

Between the end of the 18th and the first decades of the 19th centuries, archaeological excavations in the territory of Anzi had a golden age in which were brought to light, frantically and without an adequate control, conspicuous evidences of a rich, millenary past (Donnici *et al.*, 2016). However, the desire to take profits led to the dispersion of an incalculable number
– but certainly very relevant
– of ancient treasures, as a result of that real "mania of antiquities" that pervaded the European culture of the time. Nevertheless, the large number of ancient artifacts from Anzi detectable in the most important museums in the world are still today among the most relevant archaeological contexts from ancient Lucania (Donnici, 2016).

At the end of the tour route, therefore, it was prepared a specific multimedia product that realized this fundamental page of local archeology, and joined for the first time in a single virtual container a conspicuous ancient heritage, otherwise no more usable as a whole. Using a digital map with simple hyperlinks, visitors had the opportunity to explore some important Italian museums (Potenza, Naples) and international museums (Paris, London, Copenhagen, Berlin, St. Petersburgh, Genève, Tartu, New York, Rio de Janeiro) looking for wonderful artefacts from Anzi (Fig. 3).
Clicking on each of more than one hundred and fifty ancient objects collected as a result of extensive studies, users could open a sheet with a descriptions and some information data about the pieces, particularly those relating to the events that caused its dispersion. When the photographic documentation was available, furthermore, the opportunity to zoom in on the artifact in order to admire all its details was afforded.
Despite the simplicity of its structure, borrowed from the web sites of some major museums, such as the British Museum or the Metropolitan Museum, the digital content described has received a good response in terms of interest from the users, especially the local population.

(F. D.)

The app "Ritorno ad Anxia"

The contents of the exhibition were associated with digital insights collected in part inside the

Fig. 3. Structure of the digital content "*Looking for ancient finds from Anzi in the world*" (graphical elaboration: F. Donnici)

application "*Ritorno ad Anxia*" (Fig. 4.), downloadable for free from the *Google Playstore* (https://play.google.com/store/apps/details?id=appinventor.ai_antoniopecci89.Anxia_App&hl=iT).

This application was created as a gift and a souvenir to join with the classic brochure that every visitor could pick up at the beginning or at the end of the tour route at the information desk, and as an innovative way to spread the initiative even to those who have not been able to visit.

The App for smartphone / tablet Android "*Ritorno ad Anxia*" has been realized through the free online platform "App Inventor 2" (https://ai2.appinventor.mit.edu/). This programming suite is characterized by a simple and fast interface that allows to realize even very complex applications without having a thorough knowledge of programming languages (Wolber *et al.*, 2011; Sanchez, 2014).

Created the APP design and added the scientific contents, we proceeded to the building of the logic blocks that enable the functioning of the application. Within it logistical information (opening hours of the exhibition, street indication, etc.) and various information data are provided, such as the archaeological map of Anzi, the myth of the *Coephoroi*, reports about the history and archeology of Anzi from the Archaic Age to the Roman era, and a brief overview of the history of the 19th century excavations and the dispersion of numerous archaeological finds around the world.

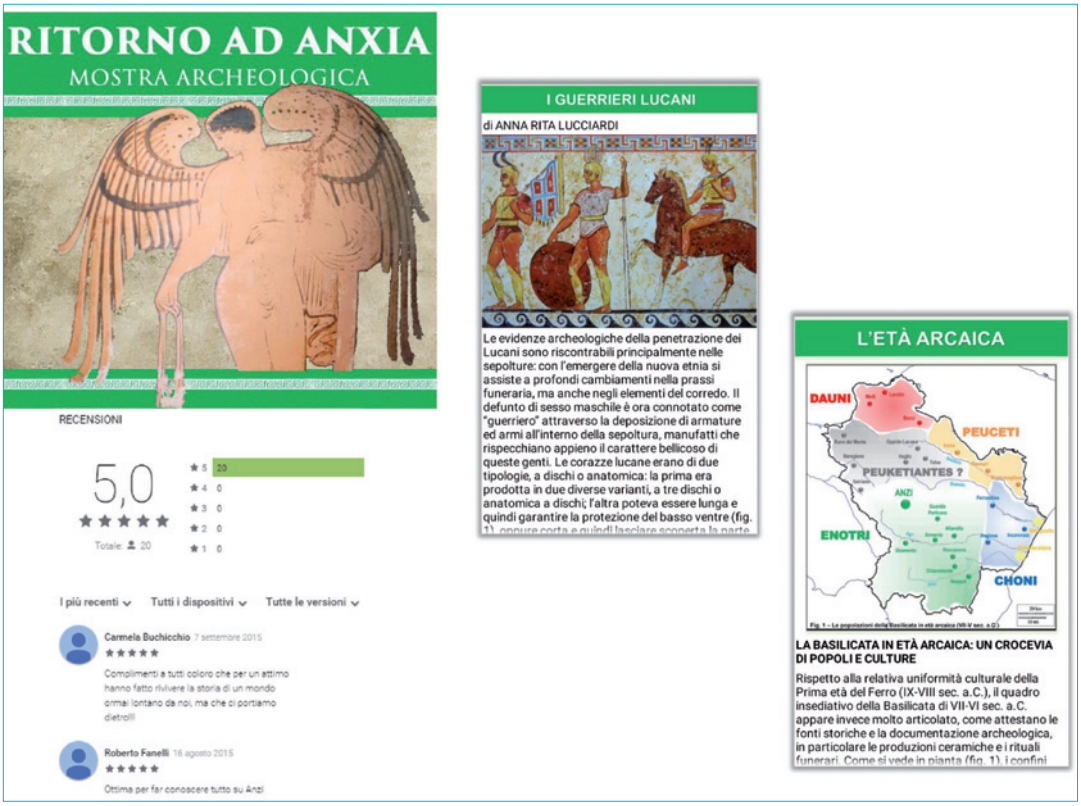

Fig. 4. The digital application "*Ritorno ad Anxia*" (graphical elaboration: A. Pecci)

THE VIDEO-ANIMATION

Within the exhibition the showing of a video-animation was also provided. It was composed of one popular part entitled "*The myth of Coephoroi in the italiote Fig.d pottery and in the vases from Anzi*", and a short movie entitled "*Coephoroi, Act One*", still visible nowdays on Youtube (https://www.youtube.com/watch?v=NeYqPsHyDzA) or within the digital APP "*Ritorno ad Anxia*". In the first part of the video a narrator explains the myth of *Coephoroi* through the showing of various archaeological finds, such as some Lucanian red-figured vases, and modern artworks that have the myth as subject.

The movie, instead, is based on the "animation" of a Lucanian red-figured vase from Anzi representing an episode of the myth. The figures depicted on the vase, Oreste, Pilade and Electra, are transformed into animated characters (Fig. 5) that interact between them following a theatrical copycat, freely drawn from the Aeschylus's *Oresteia* (Act I, Coefore). This last part of the video-animation was realized with modern animation techniques based on the software *Adobe Photo Shop* (http://www.adobe.com/it/products/photoshop.html) and *Pro Show Producer* (http://www.photodex.com/proshow/producer). Our idea of animation of a red-figured vase is inspired by an existing project named "*Panoply Vase Animation Project*" (http://www.panoply.org.uk/index.html#.V2VAZLuLTIU), which has met with considerable success between crit-

Fig. 5. Structure of the digital content "The myth of Coephorae in vases from Anzi" (graphical elaboration: A. Pecci)

ics and academics (Smith & Nevin, 2014; Nevin, 2015), and by a videogame, *Apotheon* (http://www.apotheongame.com/), whose virtual graphics recalls the iconography of Greek black-figured vases.

Conclusions

The installation of the temporary exhibition "*Ritorno ad Anxia*" has been created trying to make the tour route more interactive and exciting as possible for the visitors. In order to reach the goal we used some of the most modern fruition and interaction techniques for museums.

Through thematic and multimedia insights on tablets and through the APP "Back to Anxia" we tried to improve the interaction between the archaeological remains and the visitors, and to stimulate their curiosity. Furthermore, digital contents facilitated children's and young people's – and not only – learning, and increased knowledge of the archaeological finds and different aspects related to it (for example the Oinotrian pottery production, the war equipment of Lucanians and their language, Roman *Anxia*, etc.). The insight on the history of the

19th century excavations and the dispersion of local archaeological remains has allowed visitor to learn about the extraordinary archaeological history of Anzi and its artifacts "distributed" into the largest and most important museums in the world. This insight would have been hardly possible to realize through traditional panels or museum sheets.
Through the projection of the video-animation on the myth of Coephoroi, finally, we tried a different communicative approach, characterized by the classical documentary disclosure and by a short movie with an entertainment adopted by the cinema and video games. All these technologies and ideas have been a first test for the next and largest exhibition to be held next year in National Archaeological Museum "Dinu Adamesteanu" of Potenza.
Thanks to the most recent technologies, students, researchers and tourists could visit a temporary exhibition in a different, interactive and exciting way. They offer a complete cognitive approach and can be an additional support for knowledge, communication, fruition and development of the cultural heritage.
The next step of our project would be to create *in loco* a permanent virtual *antiquarium*, in which users can better appreciate, not only new archaeological findings from recent researches but also, through the exhibition of 3D printed models, some of the most important ancient objects from Anzi scattered all over the world.

(A. P.)

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Crowdsourcing Semantic-Aware Image-Based 3D Models For Spatiotemporal Analysis of Complex Heritage Sites

Friederike Peteler[a]*, Livio De Luca[a]

[a] UMR 3495 MAP CNRS/MCC, Marseille, France – (friederike.peteler, livio.deluca) @map.cnrs.fr
* Corresponding author

KEYWORDS: crowdsourcing, cultural heritage, semantic annotation, cloud computing

ABSTRACT

The research advances in the field of documentation and analysis of cultural heritage have provided various techniques and approaches, developed specifically to acquire accurate 3D models. In parallel numerous methods are being developed to facilitate the manipulation of this data and their interpretation, as well as their sharing on the web, to meet the requirements for an exhaustive examination. Specialized researchers perform studies on the spatial distribution of data of various nature, semantic annotation and spatio-temporal analysis in the field of built heritage, specifically for the conservation and documentation.

Nevertheless, when it comes to performing nowadays a process for the acquisition and documentation of a cultural heritage object, archeologists and architects choose in the most cases the same procedure: acquiring images and data of the heritage object, treating these with a photogrammetric software applying various algorithms on the images, like the detection of tie points, the computation of the orientation and calibration of the camera and a dense correlation for the generation of the 3D point cloud. This obtained model is used then usually just as a support for the extraction of various points of view, like sections and plans or detailed views of a prospect, to be the work base for the annotation of the considerations and research results. This is done often even on printed support, so the collected information is stored dispersed on various supports by different people and not connected with each other.

Looking at nowadays state of the art of research and technology we can imagine more innovative and exhaustive solutions for the documentation and analysis of a cultural heritage object whose methodological issues will be introduced in this position paper.

There are different types of memory, the communicative memory, which is the memory of the everyday life with a limited temporal horizon, also called oral history and the cultural memory which is characterized by its distance from the everyday and is maintained through cultural formation (text, monuments, etc.) and institutional communication (recitation, practice, observance) (Assmann, 1988). The meaning, the heritage dimension of an object is defined by these aspects of memory gathered in form of information everyday by scientists and professionals. Our goal will be to create a model to bring together the tangible and intangible dimensions and the amount of sources already produced and which get produced day by day, combining various methodologies and techniques in order to create digital layers of the data. These layers will be the bridge between the real object and the digital model which will be used as the work base for conservation scientists, archeologists, architects and historians and even the society (Fig. 1).

Cloud Computing: An emerging technology we have to examine therefore, is the Cloud Computing which is already used in several Automatic 3D Image-based modeling tools on the web. It is a

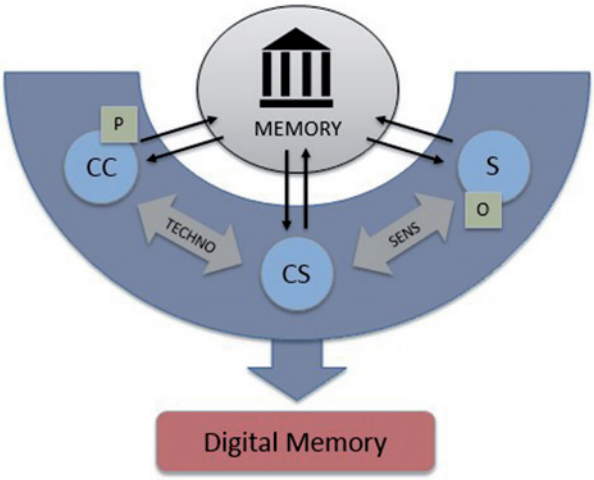

Fig. 1. Combining various techniques and methodologies to reconstruct the Memory of a Cultural Heritage Object (image source: personal elaboration)

model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (Mell et al. 2011). These tools allow to upload the acquired images of a photogrammetric acquisition, computing them on a remote server which executes a previously programmed script for the generation of a 3D model, which the user only has to recuperate in the end. Examples of Cloud Computing for the 3D reconstruction of cultural heritage are given by ARC3D system (Nilson et al, 2007), a group of tools developed by the VISICS Research Group of Leuven or the platform Culture 3D Clouds (http://c3dc.fr), both allowing the user to upload his images and computing the 3D model on a remote server. Also the project Photo Tourism (Snavely et al, 2006), where large collections of photographs are getting browsed from either personal photo collections or internet photo sharing sites like flikr, in order to reconstruct the objects 3D scene, are working with a cloud computing technique (Fig. 2). Another commercial solution for the cloud computing for a 3D reconstruction is given by 123D Catch from Autodesk.

Fig. 2. Photo Tourism by N. Snavely (image source: http://phototour.cs.washington.edu/)

Crowdsourcing: When reconstructing cultural heritage, it is not only the metrical and visual aspects we would like to collect and restore but we aim to create digital layers to register collective annotations. The data of different types of memories of an object can be collected and organized to assemble and reconstruct its memory. One methodology for the gathering of information from a crowd was created by the citizen science as a participative system which is crowdsourcing, offering potential and interesting perspectives. Crowdsourcing for the reconstruction of cultural heritage was born to rebuild with the help of the crowd cultural heritage in danger or which became inaccessible due to human destruction or natural disaster. In order to perform a crowdsourcing project a method has to be developed in which non-experts become an integral part of the scientific process. Lewenstein defined it 2004 as "the participation of nonscientists in the process of gathering data according to specific scientific protocols and in the process of using and interpreting that data." (Lewenstein, 2004).
For a photogrammetric reconstruction of a cultural heritage object this means generally that people are asked to collaborate at the 3D rebuilding of an object by uploading images on a platform which can be computed then afterwards to a model. One of the most known projects for the 3D reconstruction of cultural heritage through crowdsourcing is Rekrei, or as former known Project Mosul (https://projectmosul.org). Their objective is to promote the digital preservation of lost cultural heritage by using crowdsourcing data in a cooperative, open-source project, creating a gallery, a virtual museum of damaged artefacts. Another crowdsourcing platform example is HeritageTogether (Wilson et al, 2014). They aim to produce heritage data in conjunction with local communities to reconstruct in 3D all the standing stones and cairns in Wales. A third example of a crowdsourcing initiative which was launched for a 3D reconstruction of lost cultural heritage is the Plaka Bridge in Greece (Stathopoulou et al, 2015) that had collapsed. A request was opened to upload on the web all the images available of this bridge.
By now all the methods for the crowdsourcing of cultural heritage data consist mainly in a web interface where the participants can upload images of a monument which then are transformed to a 3D model either by experts or in some case also by experienced participants of the project. Then the result of the 3D reconstruction of the cultural heritage is available online for visualization purposes. Our aim here is to improve and advance this process by letting the people provide not only pictures and in some cases 3D models, but also useful information about the monument and its meaning.
Semantic annotation: Adding sense, semantic descriptions to a 3D model by adding tags, attributes, relations and/or ontologies to the images or the model, allows the information to be stored and aligned in one conceptual model. Starting from the definition of a formalism (De Luca et al., 2011) how to relay semantic annotations to a 3D model by annotating the images which are spatialized according to the same reference model, the CNRS-MAP Lab is currently working on a semantic-aware geometric 3D annotation cloud service which will be soon available online. In this cloud service is incorporated the method for the semantic annotation of spatialized images (Manuel, 2016), where the annotation on one image is propagated thanks to an indexation to the other spatialized images (Fig. 3). The semantic annotations of

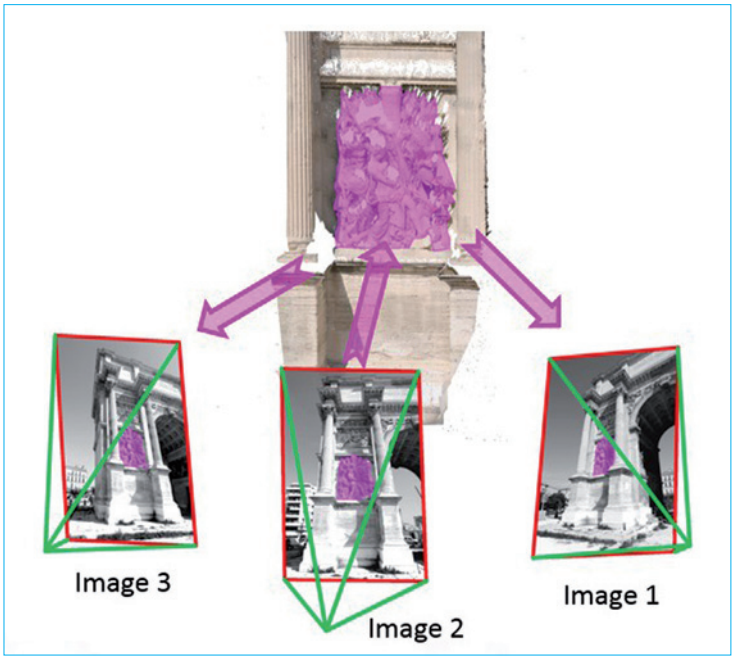

Fig. 3. Semantic annotation on spatialized images (image source: Manuel, 2016)

heterogenic backgrounds can be structured then using ontologies or normalized vocabulary terms and different layers for the historically, typologically different issues in order to allow an easy query process for the investigation of the huge data base constructed by the crowd and experts reconstructing the memory of a cultural heritage object digitally.

Therefore, existing Cloud Computing Applications providing the technological solutions for a 3D reconstruction of a cultural heritage object due to elaborated algorithms and servers available for the automatic 3D image based modeling tools on the web and being able to take inspiration of some crowdsourcing initiatives for the reconstruction of lost heritage which are lacking of technological solutions we are imagining to combine these two techniques and add even the aspect of semantic annotations. Like this sense will be added to the cultural heritage to be rebuild in a participative way in order to reconstruct the memory of the building and not only its metric aspects.

The development of a participative system for the collection of data of various nature, such as photographs, iconographic resources, drawings, paintings and prints for example and the following process of spatialisation and semantic annotation of this data implies several problems. A challenge is given by the spatial orientation and matching of the mass of heterogeneous information collected, which documents the object at different temporal states and light conditions and is composed of various dimensions and contains dissimilar metadata. Once spatialized the data set using the technologies of an automatic image-based modeling process based on cloud computing techniques, it is possible to perform the semantic annotations to serve as support of analysis for the prevention, conservation and documentation. The semantic annotation requires the implementation of various methodologies like the identification of a normalized lexical ref-

erence or the creation of different layers for the historic and scientific lecture for the information deriving from several contexts. To obtain reliable and accurate data for the object analysis also the procedures to follow have to be established and the ergonomic aspects of the platform have to be studied to facilitate the collaboration of all the 'amateurs' who would like to participate at the project. The whole data will be organized in one big web platform which will be the work base for the description of the cultural heritage object in form of a digital memory. On this work base can be performed then various queries thanks to the multiple and heterogeneous information stored on the model. We can find for sure metric information for quantification studies for example. Since the images are also temporal testimonials, also the different temporal aspects of the artefact are documented and can be analyzed. Also cultural values can get expressed by the images and through the semantic annotations fragments of meaning of the object within a collective memory of the society will become evident. The relationships between the various annotations can be studied in order to learn more about the building and its society. Since every actor has also its own point of view on the object, even the individual perception gets expressed and the heritage value, the memory can get reconstructed by the humans itself, restoring the cultural heritage object itself but also its sense and meaning.

Case study: This position paper introduces the methodological issues related to this subject by using the walls of Diyarbakir (since July 2015 part of the UNESCO's World Heritage List) as case study. These roman city walls in black basalt are dating back to the end of the IV sec and are almost 6 km long. They present numerous towers, reliefs and inscriptions and are one of the rare roman city walls in the Middle-East almost conserved. We already have a large collection of photographs dating from different temporal moments and of different levels of detail, which will allow a first study for the assimilation of the data which will be implemented then by the realization of a crowdsourcing platform in order to test our approach.

We imagine that soon on a platform we could have a first person who has done a photogrammetric acquisition on a part of the Diyarbakir city walls, whose images are then computed on the cloud to reconstruct a first 3D model of this part. Then a second person joins the platform by uploading a tourist image he has taken in front of the walls. A third person instead, a conservation scientist for example, is interested in a graffiti and he takes a detailed image. Each added images gets oriented together with the already uploaded images. Then the conservation scientist or even another person might do an annotation on the photo by highlighting the graffiti. This annotation gets transferred in the 3D model and other images containing this part of the walls, so that we could perform for example spatio-temporal studies by consulting older images to see if the graffiti appears already on these images. Another person again might be interested in the degradation status of the walls and starts the annotation of the first images. Its annotation gets transferred as well on the 3D model and the other images containing it. Like this, we could go on and on adding more and more images and information to this digital memory documenting this cultural heritage object in all aspects and creating a huge database in a participative way for continuous queries and analysis. The common denominator remains the monument itself, the real building, using the semantic annotation as the engine to query this informative continuum model (Fig. 4).

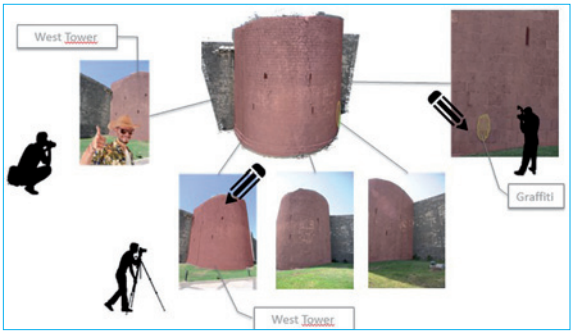

Fig. 4. Collaborative documentation and analysis of a Cultural Heritage Object (image source: personal elaboration)
Fig. 5. Possible Interface for the Digital Memory of the Diyarbakir city walls (image source: personal elaboration)

The Diyarbakir city walls components will be located, measured and described using the tools developed on the crowdsourcing platform which will enable a virtual disassembly of the walls according to several levels of analysis and detail. A precise lecture of the elevations will be imaginable to document the surrounding walls and the history of Diyarbakir. In the database will be integrated different types of documents which will forward to more detailed files. Expressing a simple request, it will be possible thanks to the annotation tools and the spatialized images, to browse the data base of the wall thematically, diachronically or even typologically and start spatio-temporal studies of this cultural heritage object.

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Integrated Strategies of Promotion and Communication For Diffuse Cultural Heritage: a Pilot Project Inside Flaminia Nextone Dce

Giulia Crinelli, Paolo Clini, Ramona Quattrini, Francesco Leoni[a]

[a] DICEA, Dept. of Civil and Building Engineering and Architecture, Polytechnic University of Marche, Ancona, Italy – giulia.crinelli@gmail.com, (p.clini, r.quattrini)@univpm.it, architettoleoni@gmail.com

KEYWORDS: Archaeological landscape; Brand identity; Cloud library; Digital drawing and survey; Cultural district.

ABSTRACT

This study means to examine new ways to improve the promotion and awareness of an ancient and hidden consular route: The Via Flaminia. The main goal is to develop new methodologies to create a diffuse museum throughout a tangible and intangible digital project highlighting the route.

Nowadays the increase of transport infrastructures erases a lot of archaeological evidences, covered by newer and faster road infrastructures. In the Marche Region, especially from Scheggia Pass to Fano, the roman traces of this route are not so easily identifiable because of vegetation and lack of maintenance. Moreover, each evidence does not raise such an interest in both tourists or resident. For all of these reasons, it is necessary to promote a sustainable cultural tourism along all the path, integrated with local development, to amplify the cultural identity linked with the Via Flaminia.

The results of the analysis focus on the importance in using resources to activate an appreciation process, linked with cultural, economic and touristic aspects involving industries' and citizens' interests. The best methodology consists in promote the re-appropriation of the area by everyone: the diffuse musealization has to be reinterpreted.

The first step consists in mapping the area, localizing the Via Flaminia's path and all the archaeological evidences. Several drawings, survey, spherical panoramas and 3D models on the Flaminia road and its evidences, has been carried out about by Univpm's researchers. Along the road four areas are identified as focal point of the diffuse museum system: POI and Pilots are linked to a cloud platform that leads to a better comprehension of spaces and innovative communication systems.

Another important aspect consists in the creation of a unique language for the all the route, a coordinated image project to give immediate legibility and recognisability. Each municipality crossed by the Flaminia is part of a unique system designed through the idea of those large stones (basoli) that paved roman streets. Starting from the project's logo (made of basoli), its shape gives origin to the idea for the website, app and signage. As well urban furniture's design is developed by the logo's idea.

Finally, a pilot area has been focused on: Mallio Bridge at Cagli is designed as the entrance to the city and one of the main points of interest of the all Flaminia in Marche.

Introduction (P. Clini)

In this paper is presented an innovative way to approach and improve the archaeological landscape, based on researches about *Via Flaminia*.

The *Via Flaminia* is an ancient consular high road of Italy, constructed by C. Flaminius during his censorship (220 B.C.). It used to lead from Rome to *Fanum Fortunae* and *Ariminum*, and

was the most important route to the North (Agnati, 1999). The area along Ancient Flaminia is an extraordinary land that collects layered remarkable characteristics and the now visible archaeological evidences are rather unique. This aspect depends on the number of cuttings and bridges, stretches of pavement, tunnels, drainage and support structures, roadside *cippi* and inscriptions which still exist along the way. These represent very important archaeological remains since they document many centuries of construction along the road.
In 2013, in order to promote economic cultural-based development, Marche Region launched a project called "Cultural Evolved District" (DCE -Distretto Culturale Evoluto, in Italian). A strategic project for the Flaminia's area has been indicated among several proposals. The project, called Flaminia Nextone will discuss and analyse current and future trends in several technology and representation domains identified as key areas.
The Nextone project investigates the potential of digital cultural heritage stimulating a brand new cultural industry that will fosters economic growth and occupation in this area of Marche Region. The project has a public-private partnership with some SMEs engaged in technology, cultural industry and heritage exploitation. The project promotes a local development, starting from tangible and intangible cultural complex and ICT tools, increasing competitiveness and attractiveness of suburban areas (EU Commission, 2010; EU & Comité des Sages, 2011).
This paper demonstrates how it is possible to increase this identity and promote cultural tourism in the region, thanks to innovation in digital cultural heritages, survey, investigation and representation of architectural and archaeological heritage.
The goal, in the Nextone project, is mainly to carry out research applications, concerning cultural institutions tasks and multimedia installations, especially connected to archaeological museums. Nowadays, they are turning to simple storages of artefacts to active places that offer more information, emotive involvement and added values to visitors' experience (Camarero, 2015).
A main target is to enlarge the knowledge, appreciation and exploitation of *Via Flaminia* cultural historical sites, starting from existing databases, carried out from researches too. The data will be managed in a cloud storage that will encourage public-private partnerships for heritage digitization.
The chapter explains resources and methods involved in the "Flaminia Nextone" project: several drawings and surveys are reused to build a whole digital intangible heritage about Flaminia area and to reinforce cultural identity through a widespread (outdoor & indoor) museum. The aim of the paper is to show and validate an easy way to make affordable, sustainable and economically productive the protection and the exploitation of the archaeological heritage and landscape (Clini, 2015).

The context: the regional project and the state of art (G. Crinelli)

The ancient infrastructures and their use, in the last centuries, allowed economic, social and cultural development: their life was a source of wealth, prosperity and innovation, allowing

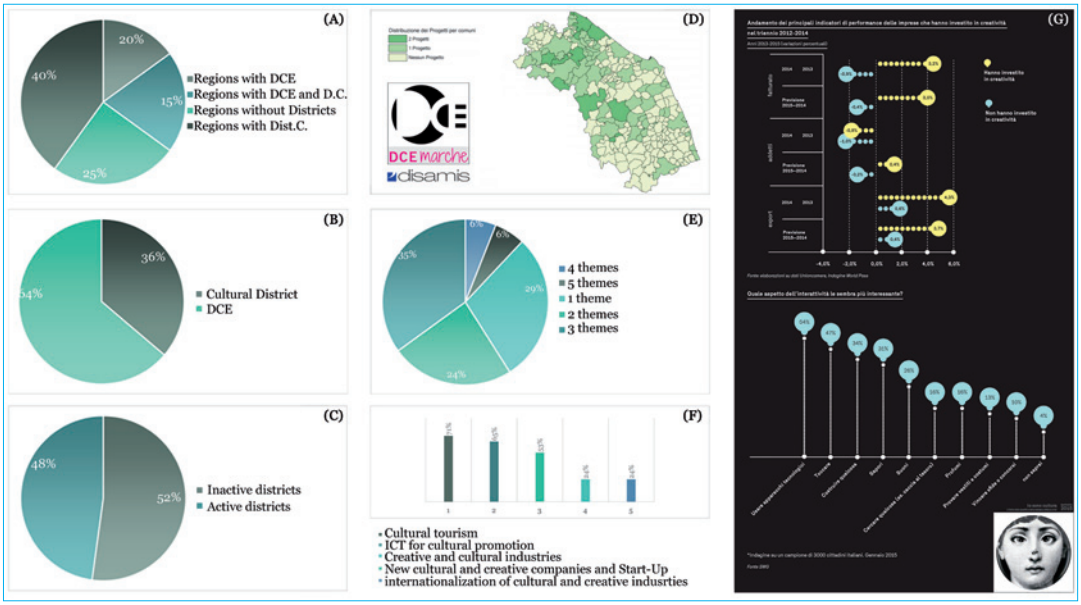

Fig.1. (A) Districts distribution in Italian regions, (B) Diversification between districts, (C) Still active districts, (D) Projects distribution through the region (http://culturamarchelab.regione.marche.it/2015/11/27/il-distretto-culturale-evoluto-delle-marche-numeri-stato-dellarte-e-prospettive-europee/), (E) DCE projects for number of themes, (F) Subjects of DCE project, (G) Creativity and interactivity in various aspects (Symbola 2015's report).

the transmission of values and developing a cultural identity. Despite the *Via Flaminia* was one of the most important roads up to 30/40 years ago, today the district suffers the typical problems of extra urban areas.

One of the major problem in this context is the lack of connection between cultural heritage (widespread in landscape) and centres (town, productive areas and business activities).

The road that yesterday was made of stones now may be a virtual infrastructure, using cutting-edge technology, which recovers and regenerates the territory. From this suggestion was born the project name Next – stone, that collapsed in Nextone.

This is the key concept of the project, based on a Mobile Cloud Library, at the service of economic and tourist operators, citizens and tourists, scholars and art-lovers, tanks to public-private partnership involved in project.

In the creation and development of the cloud infrastructure, among several values and contents, researches' group performs the contents connected to the tangible heritage, starting from survey based models and their analysis. Other project partners will perform the economic issues and the touristic exploitation of Flaminia area through the Cloud.

Analysis made on Italian cultural districts show the best practice to improve cultural impact upon local development. In Italy there are 69 districts related to culture, not all of these are still active, and the distribution varies between the different regions, 44 are cultural districts, the remaining 25 are evolved cultural districts (DCE) (Le Blanc, 2010; Lorenzini, 2011).

For what concerns Marche Region, 17 DCE are seated there, 4 of them by regional initiative

and 13 with regional interests. In this initiative are planned 147 projects: 32 for cultural heritage promotion, 15 to improve tourism, 16 about ICT, 9 to encourage new start-ups.
According to Symbola 2015's report in Italy the ones who focus on culture and creativity to strengthen the manufactures demonstrates that culture is the answer to promote local development. In fact, the companies involved in the Italian cultural production system (cultural and creative industries, visual and performing arts, activities related to the historical heritage management and artistic production of goods and services) produce 5.4% of the all richness produced in Italy (78.6 billion euro). Arriving in about 5.8% of the national economy if included public and non-profit institutions (Fig.1).
It has to be noticed that culture has the power to contaminates the rest of the economy and from industries performance indicators is clear that investing in this area of expertise brings economic advantages.
Nowadays museums are the most important actors in cultural field, they can generate a flow of cultural production. The change is due to users always more interested in technology improvements.

The Flaminia's heritage and its development strategies (R. Quattrini)

Considering the purpose of this chapter, it is interesting to briefly describe the buildings and main archaeological evidences in Marche Region's administrative limits, involved by the Nextone Project (Fig.2). At Pontericcioli, is placed the *Ponte Grosso* bridge that presents two arches separated by a little water divider. *Ponte Mallio* is the entrance in Cagli town. The central archway is very large, the bridge is constructed by vast blocks of grey cornelian stones and it was built at the end of the Republican Period.
Further along the road there are viaducts, *chiavicotti* and substructures (*sostruzioni*) that have different building techniques. The ancient abbey of San Vincenzo, in the Acqualagna town, has a viaduct built during the republican period, using the local Furlo's stone.
At the Furlo Gorge there is another extraordinary work of engineering. An artificial terrace supported by imposing substructures, that for a long time aroused the amazement of travellers, was created. To overcome a rocky spur were created an almost 30 meters high terracing walls on which the road was placed. Subsequently a first smaller Etruscan age passage was engraved in the stone, the parallel tracks formed by the wheels of the chariots are still visible on the rock's surface (Luni, 1993). The final solution came with Vespasian who initiated the excavation of a second tunnel ensuring a way through the pass for two thousand years and giving its name to the place: firstly, *Petra Pertusa* (pierced rock), then *Forulus* (tunnel).
From here, the Flaminia continues on to Calmazzo. In direction of Urbino, the *Via Flaminia* is connected to the Metauro Valley. In the direction of Adriatic coast, the Flaminia crosses a large and very relevant archaeological site, known as "*Forum Sempronii*". It is generally established that the town dates back to the *Caius Sempronius Gracco's* time and the *forum* dates between

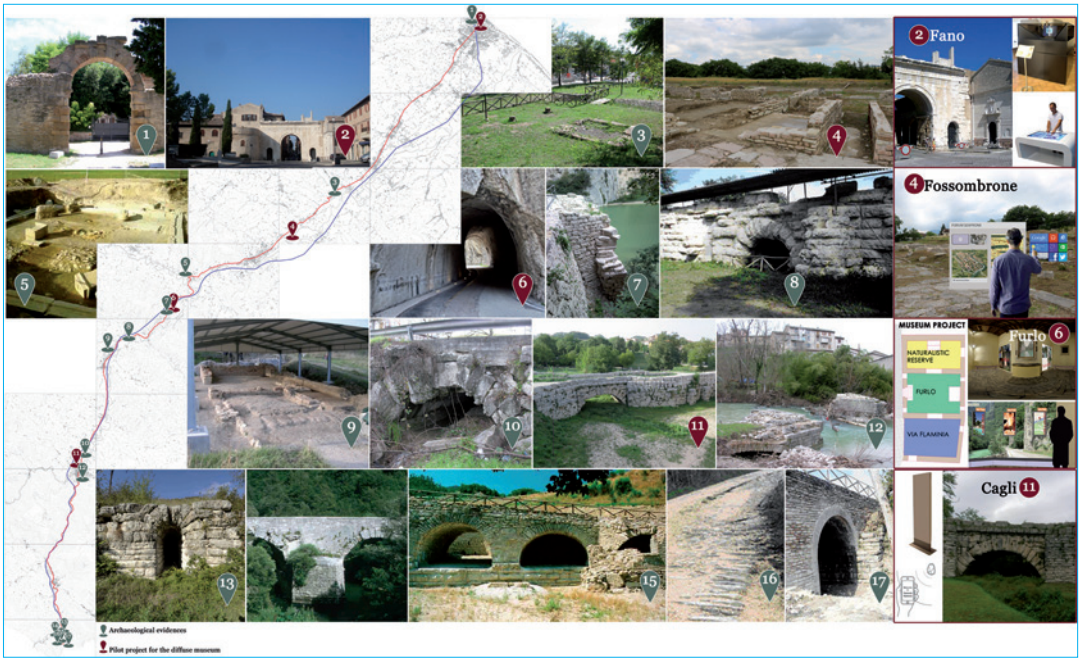

Fig. 2. Regional technical map with archaeological evidences. The ancient *Via Flaminia* is highlighted in red, the new one is in blue, all the archaeological evidences have been pointed out, numbers 2, 4, 6 and 11 are pilots (2) Arch of Augustus in Fano, (4) archaeological site "*Forum Sempronii*" in Fossombrone, (6) Tunnel and "S. Maria delle Grazie" church at the Furlo Gorge, (11) *Ponte Mallio* is the entrance in Cagli town

133 and 126 BC. It is possible to see also the remains of a *domus* (or family house) with thermal heating system, and a long stretch of basalt paving which is parallel to the Flaminian Way (De Sanctis, 2010; Luni, 1990, 2002).

The major ancient centre on the Flaminian Way, directly involved in the project, is Fano (*Fanum Fortunae*). The Emperor *Augustus* into the *Colonia Julia Fanestris* successively transformed the ancient town built around an ancient temple dedicated to the Goddess *Fortune*.

Fano yet retains its ancient grid-like layout of streets and different tracts of basalt paving have been found just under the level of the actual road. Among the monuments dating back from this time, there is the triple-arched *Arco di Augusto* (Arch of Augustus) as well as the underground remains of a big public building, which may either have been the *Basilica* of Vitruvius that is described in detail in his treatise *De Architectura* (Fano Municipality, 1992).

During the project engineering, some pilots have been chosen to promote a widespread musealization of lands and to create tangible attractions in the area. A Pilot is a place where is possible to experience the best replicable practices of musealization throughout digital technologies and historical, artistic and environmental assets monitoring (Clini, 2013).

By this process new creative specializations and integrated industries will be promoted. Right into these places is concentrated the most of the digital technologies of the all district. Placing these points of interest, it is possible to create a network suitable for both tourists and residents to discover and appreciate all the area.

Fig. 3. Project's logo is inspired by the basoli, the coordinated image of Flaminia Nextone's project develops from the logo to every design aspect as well as website graphics and urban furnishings.

Flaminia Nextone project involves not just a single object, as a museum or an archaeology, but an entire territory. Is important to keep in mind that the success is related to the ability of creating a univocal and recognizable local brand. The goal consists in creating a complete, saleable, cultural and touristic product. Until today Italian tourism has always been improvised and self-managed by individuals. Nowadays the level of the middle range tourism raised up, for these reason it is necessary to create customisable holiday packages to experience artistic, cultural, environmental, gastronomic, accommodating and entertainment aspects.
A visual image of a project in user's mind is the brand identity. The recognisability of the identity is the biggest strength of every market strategy to be distinguished from others competitors. Uniformity is important to fix in users' mind a local identity. The coordinated image of Flaminia Nextone's project develops from the logo to every design aspects to guarantee homogeneity, coherence and a unique language for the all route. Each municipality crossed by the Flaminia is part of a unique system designed through the logo's idea of those large stones (*basoli*) that paved roman streets. The image has to guide users through the area's learning and its values. Starting from the project's logo made of *basoli*, its shape gives origin to the idea of each design's part.
All governance that lead to the subsistence of this district is declined for users in a website linked with an app. The included functions allow users and residents to live the DCE in its totality using a "responsive" design suitable for every device.
Ass well as app and website, even signage and urban furniture's design is developed from the logo's idea. In this way users feel part of a global system. A single project that communicates unity. The material is grey reinforced cast-stone with anticorrosion, waterproofing finishes (Fig. 3).

The case study: the Mallio's bridge area (F. Leoni)

The study of coordinated image project focused specifically on Cagli's Pilot, the archaeological area of Mallio bridge. This zone, compared to the hollowed context, is very strategical for the

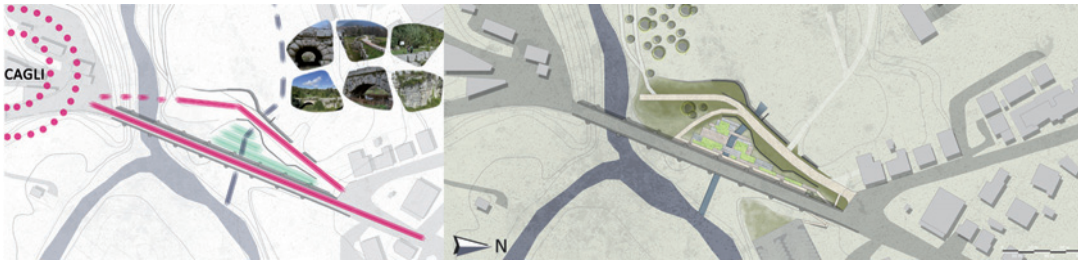

Fig. 4. The concept of the project and the layout. The design of Mallio Bridge at Cagli intend to add value and new functions to the area. The accessibility and fruibility is guaranteed by an aware use of design and materials to comply both the archaeological evidences and land branding image.

city because it is settled near the historical centre and next to the Bosso and Burano rivers confluences. Actually the area is unused and in a predominantly natural environment.
Planning the area means to add value and new functions to the context, by giving accessibility and usability (Fig. 4).
The location is ideal to be used as main entrance to the city, here a park allow to leave vehicles outside the city centre. A ramp from the park until the hollowed area introduces visitors to the archaeological area using explicative signage. The design of the area is minimal to not impair with historical evidences. All elements are designed to give the visitors an easier interpretation of the original spaces distribution. Because of the changings in riverbeds is not possible to restore the ancient path so just a section of it has been restored on Mallio bridge until a spur of rocks overhanged the river. From this point the path proceeds along the embankment. The area between the two bridges, the ancient and the new one, is swampy and this damages the roman evidence fostering growth of vegetation and structural instability. To solve the problem and simplify the interpretation of the area, a canal has been designed on the antique layout of Bosso river under the roman bridge to drain water into Burano river. The design of the square is parallel to the new bridge. Pavements and flowerbed are straight-lined to distinguish new parts from the original ones of the artefact. The materials used are artificial stone slabs whit dry application.
Since all interventions lying on a historical listed area have to respect evidences, is used Levocell (Levostab 99) as material for Flaminia's route because stabilizes natural terrain, transforming ground in a resistant, long-lasting and accessible path. Stone slabs, shaped as *basoli* with engraved information, are settled on the ground of the footpath to recall both project's logo and ancient paved roman streets. The whole project is completely reversible and environmentally friendly (Fig. 5).

Conclusions

The visual recognition of the "Flaminia Nextone" has been promoted by creating a land branding of the territory, to encourage a further action of tourism development, promote

Fig. 5. Diurnal and nocturnal project views

landscape architecture initiatives and recover degraded areas connected to ancient path of *Via Flaminia*.

The success of the project is related to the study of a background made by Italian realities and to the possibility to create a recognizable, evocative and clearly readable local brand, to develop a cultural, touristic and saleable product. From the shape of the logo are derived geometries of urban furnishings and design of digital products for the 3D and cartography data management in web site and App connected to the Cloud.

With this work is intended to raise awareness among the administration of Italian artistic and cultural heritage to encourage the creation of regional brand able to promote the visual recognition of the "path". In fact, with the fulfilment of the strategies to make the initial project executive it has been realized a tangible demonstrator in this area for what concerns the promotion of diffused heritage, typical of the Italian territory.

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Conservation of Archaeological Heritage: Management and Innovation Policies

Laura Baratin[a*], Alessandra Cattaneo[b], Elvio Moretti[c], Sara Bertozzi[d]

[a] DiSPeA, Department of Pure and Applied Sciences, School of Conservation and Restoration, University of Urbino Carlo Bo, Italy – laura.baratin@uniurb.it
[b] DiSPeA, Department of Pure and Applied Sciences, School of Conservation and Restoration, University of Urbino Carlo Bo, Italy – alessandra.cattaneo@uniurb.it
[c] DiSPeA, Department of Pure and Applied Sciences, School of Conservation and Restoration, University of Urbino Carlo Bo, Italy – elvio.moretti@uniurb.it
[d] DiSPeA, Department of Pure and Applied Sciences, School of Conservation and Restoration, University of Urbino Carlo Bo, Italy – sara.bertozzi@uniurb.it
* Corresponding author

KEYWORDS: Conservation, management, innovation, maintenance, GIS

Italian architectural heritage in the last few years has suffered a great deal for the lack of care and for the management difficulties that the bodies, responsible for its protection and value enhancement, have had to cope with; all this further aggravated by the precarious economic and political situation that the Country is going through at this moment. In particular the management of the archaeological heritage is a subject of constant critical consideration, above all as regards the real effectiveness of some intervention policies – both public and private – regarding its conservation and value enhancement.
What we observe is the great difficulty in finding suitable forms of management for such complex realities. This complexity is due to the fact that for them it is necessary:

- to assure financial resources for a sufficiently long period (at least five years);
- to find efficient forms of governance (both public and private subjects);
- to guarantee greater stability to implementing the administrative actions;
- to implement efficient management organisations which accommodate the new technologies;
- to form a new management that is capable of combining efficient management with quality cultural planning which achieves the objective of stimulating the cultural knowledge and growth of both Italian and foreign citizens.

Therefore the need arises to define characteristics, objectives and procedures for a correct and conscious planning and programming of the interventions in these extremely particular situations, not forgetting that any intervention, however it is conceived, is always a form of outside interference on something frozen in time at the moment it was brought to light. Already starting from the excavation up to the restoration, every operation on the ancient asset undoubtedly determines a loss of matter and its change; added to this there is the responsibility of a decision that is primarily moral and directs the choices to be operated to the various levels. Adopting one type of technical solution rather than another cannot be determined by an aesthetic preference, nor can it be guided by a romantic prejudice without any objective scientific validity. It

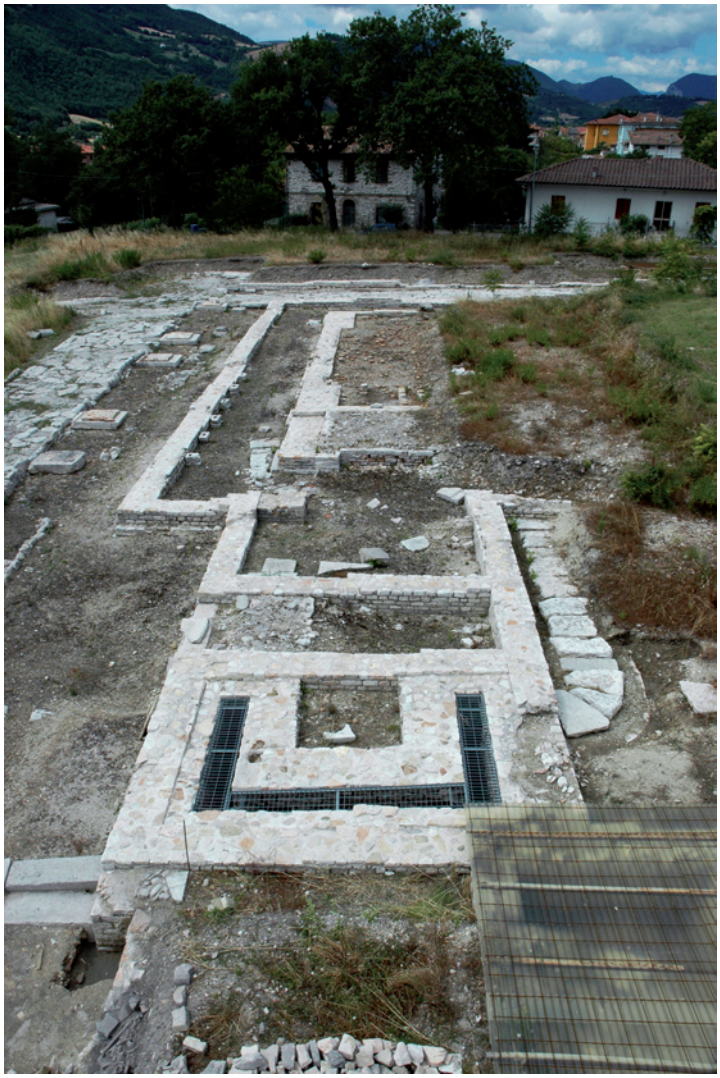

Fig. 1. Aerial view of Forum Sempronii (photo O. Mei)

is, therefore, necessary to set up conservation, value enhancement, management and use programmes in a global and systematic perspective and not, like what happened in the past, with partial, occasional and emergency interventions which had no rational planning behind them. In order to make this it is necessary to identify and analyse all the key elements that, in constructing a management system, or better "*cultural value enhancement*", may influence the definition of the organisation structure, the functions to be carried out, the management form and the judicial model, through which they manage to regulate the economic-institutional relations and the management system. Basically a new *management culture* must be constructed.
To this purpose the archaeological area of *Forum Sempronii* (Fig. 1) was one of the several cases in which the research group set up the study in view of what is indicated above.

The work, based on a vast survey and data processing operation – followed by an integration in the GIS system – had the objective of being able to achieve guided planning for maintenance and value enhancement of this great archaeological heritage. We firstly controlled whether there was a coherent management and value enhancement policy for the site capable of combining the needs of the institutions responsible for protection with those of the public and above all private subjects, called upon to collaborate in the management and enhancement of the archaeological area.
Unfortunately what we found, as well as in other archaeological areas, is the lack of a process capable of reactivating the life of the archaeological asset – removing it to its *fossil* condition – as an active town planning instrument bearer of meaning and functions.
As a result of the absence of suitable strategies for enhancing the value and sustainable forms of management, many interventions performed provide insufficient collective benefits. The critical element found is the limited capacity to programme and plan the *ex ante* management and with medium term time frames, namely to base this programming on a logical path of preliminary assessment, capable of guiding the choices and of simulating the conditions of sustainability of the management system; basically, to set up a managerial model which is coherent with the conditions of context, with the potential of the asset/service, with the expected demand and with the local social and institutional fabric. And the outcome of this assessment dictates the choices and the trends regarding cultural management. This represents the typical case in which it becomes necessary to carry out a preliminary analysis of the financial sustainability between the priority criteria and instruments in management decision-making.
The question of maintenance is fundamental in defining the possible strategies for a better management of the sites, in view of an ideal process of management and value enhancement of the archaeological potential. Indeed even the Code of Cultural Heritage (Legislative decree 42/2004 and subsequent modifications and integrations) at article 29 paragraph 1 says: "*the conservation of cultural heritage shall be assured by means of a coherent, coordinated and scheduled activity of studying, prevention, maintenance and restoration*". From the case studies examined, it is being highlighted how some of the main factors of vulnerability of archaeological sites can be aggravated or even caused by insufficient or even the absence of maintenance. Therefore, on the basis of prior experience, field sheets have been prepared which provide real instruments for controlling and monitoring the assets under examination. The sheets related to the Maintenance Plan offer the operator the possibility of keeping the *"health status"* of the asset under control effectively and actively in the short, medium and long term. By analysing the actions to be performed and calculating the cost of achieving them, they would become essential technical instruments for drawing up the *management plan*.
To conclude, it can be stated that today, in order to perform *maintenance as a process*, for preserving archaeological heritage, it is necessary to implement suitable protection and management policies and to limit the individual and uncoordinated actions in time as much as possible. All this can be implemented only through the maintenance – conservation combination – with technological innovation and thus materializing the conceptual approach of con-

servation in a prevention and maintenance activities to be put in place with the application tools, such as GIS, evolving.
The winning formula may, therefore, be that of professional management of culture coupled with technological innovation, without ever forgetting that restoration is an act of culture and that a good intervention is based on the ability of knowing how to combine needs of conservation with the needs for innovation dictated by modern times.

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Photographic sources

Fig. 1. Private photo archive O. Mei

The Representation of The Landscape as Construction Of Knowledge

Mario Centofanti, Stefano Brusaporci, Vittorio Lucchese, Pamela Maiezza

☞ Department of Civil, Construction-Architectural and Environmental Engineering, University of L'Aquila, Italy

✔ KEYWORDS: Landscape, Historical Settlement Systems, Historical-Critical Analysis, Territorial Information System

ABSTRACT

The study of landscape, understood as an interaction of historical settlement systems with that environmental naturalistic system, requires the identification and recognition of the values that characterize it.

The present study is founded on a methodological approach based on the documentation and the critical analysis of the values of settlement systems and architectural heritage.

Through critical thematic investigations, the territory is read in order to highlight the value systems related to each other. The purpose concerns the construction of a complex system aimed at knowledge and representation of the landscape and its values. From instrumental point of view, a territorial information system has been developed. With relation to this, there is the issue of the definition of complex databases, useful tools for documentation and analysis of the heritage.

Introduction

The cognitive framework concerning the recognition and census of the historical architectural heritage has his methodological basis on a historical-critical approach to the study of

Fig. 1. The Gran Sasso landscape with the castle of Pescomaggiore (Stefano Brusaporci)

settlement systems and architectural heritage. Those are also considered in their complex structure and urban and landscape interrelationship, so buildings are bearers of specific historical and / or aesthetic issues, synthesis of modification and stratification processes occurred during the building's existence. In this sense, they are "artifacts" that constitute the material manifestation of successive building cultures occurred through time.
In order to read the territory as an "integrated complex system", we proceeded through thematic analysis, which support critical readings highlighting the synergy of related systems of value elements, i.e. the "anthropic elements related to the landscape 'and' humanized natural elements". In this way, there is the need for a complex integrated approach, based on the heritage documentation and critical readings of values.
Therefore, from the instrumental point of view, a geographic information system with dynamic features for the expandability, upgradeability and interactivity has been carried out.
This system is related to the issue of the definition of complex databases, useful for documentation and analysis of architectural heritage with different characteristics, textures and extensions, according to synchronous multi-scalar views with different levels of detail.
The paper presents the results of a study born in the framework of an agreement between the Department of Civil, Construction-Architectural and Environmental Engineering and Municipality of L'Aquila. The purpose was the realisation of "preliminary analyses regarding aspects of the cultural and landscape heritage and consistency of building and urban fabric and VAS, in support of the drafting of the new General Plan of the City of L'Aquila".
The working group was involved in the recognition of the historical, artistic and cultural heritage especially in the L'Aquila territory (Fig. 1). The purpose of the study was the construction of a complex system for the understanding and representation of the landscape and its values. Mario Centofanti coordinated the research and he is the author of the "Introduction"; Stefano Brusaporci is the author of paragraph "The landscape features"; Pamela Maiezza is the author of "Representing the landscape"; Vittorio Lucchese is the author of "The transformation processes: two case studies".

The Landscape Features

The "European Landscape Convention" (2000) defines the landscape as "an area, as perceived by people, whose character is the result of actions and interactions of natural and human factors". The landscape, therefore, arises as a complex and integrated system, result of a modification and layering process. The "UNESCO World Heritage Cultural Landscape" (2009) puts the concept of "culture" as the foundation of the landscape, according to an interpretive line that tends to unify in this concept both the tangible and intangible values.
Here, what has been highlighted in the "UNESCO Convention for the Safeguarding of Intangible Cultural Heritage" (2003), which is intangibles are constantly recreated by communities, appears in all its relevance. This implies a bottom approach that tends to replace the authoritative role traditionally played by scholars in defining the values, with participatory and dynamic processes (Silberman, Purser 2012). This approach has the advantage of highlighting

important cultural dynamics, which only seemingly run counter to recent lines of study that, set of approaches related to the so-called "New Realism" (Ferraris 2012; Campbell, Smith 2016), return to focusing on "tangible" aspects as reference critical element.

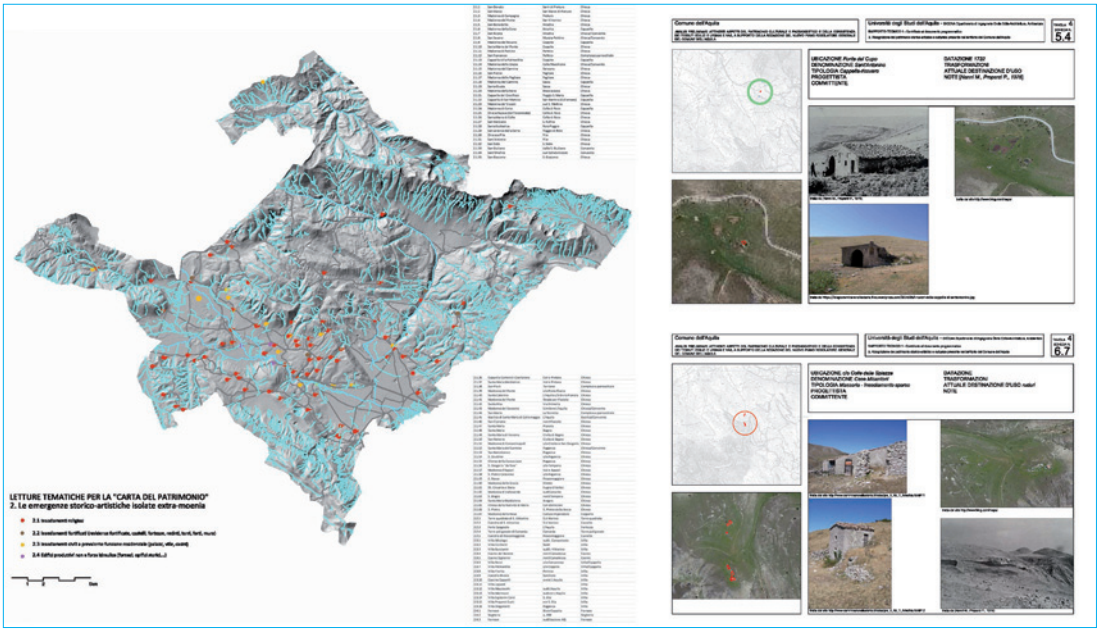

Fig. 2. Thematic readings for the Charter of the Heritage: The isolated historical-artistic buildings extra moenia (elaborated by Vittorio Lucchese)

In this sense, the cognitive framework for the recognition and census of the historical architectural heritage of L'Aquila has its methodological basis in a historical-critical approach to the study of architectural heritage, also considered in its complex structure, urban and landscape interrelationship. The synergy of value elements, which constitute the complex and integrated system of the territory, gives rise to issues of increased historical – cultural value, much greater than that resulting from the simple and uncoordinated reading of individual artifacts. The proposed study is "thematic" for the contents and values, and "critical" for the analysis of the transformation processes in relation to the protection requests of the historical and architectural heritage. From a methodological point of view, the approach aims at identifying and "recognition" of values, as well as the orientation of the protection and enhancement actions, through the reading of the territory as the intersection of historical settlement systems with the naturalistic environmental system.

Representing the Landscape

The *Charter of the historical- architectural and cultural heritage* of the Municipality of L'Aquila, in digital format, is made up of planimetries in the appropriate scale, thematic repertoires, written-graphics and photographic sheets aimed to the identification of the values.
For the drafting of the *Charter of the Heritage*, the following thematic readings have been identified:

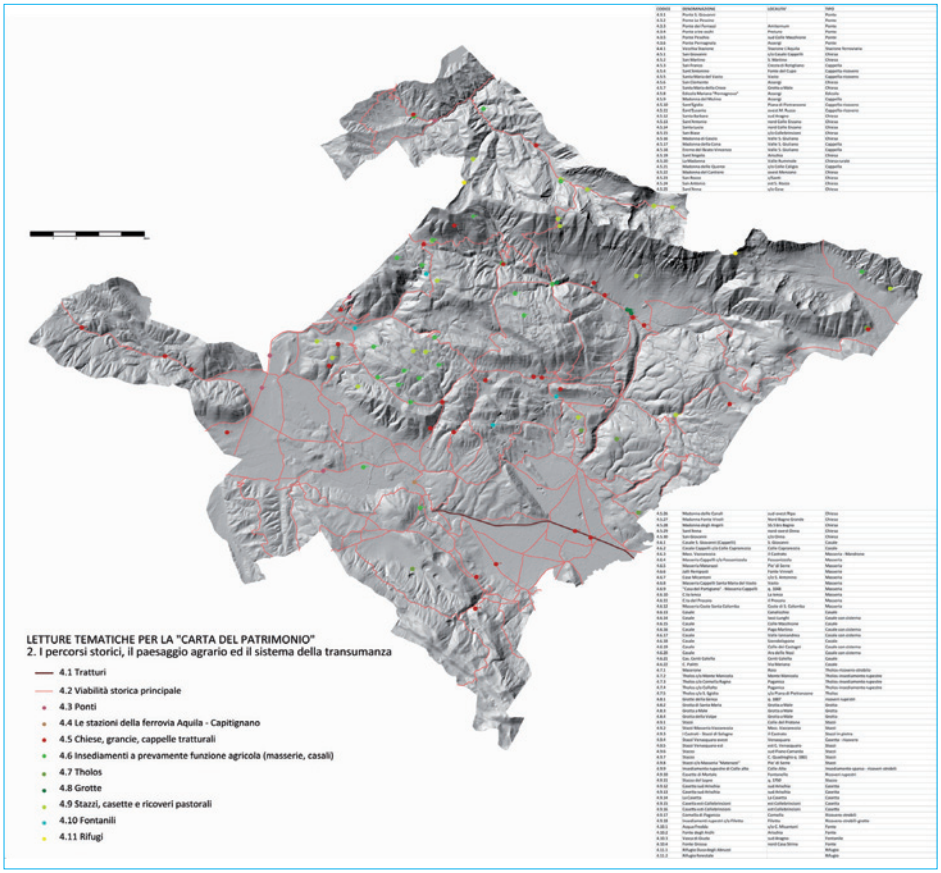

Fig. 3. Thematic readings for the Charter of the Heritage: The historical paths, the agricultural landscape and the transhumance system (elaborated by Vittorio Lucchese)

1. Historical centre of the territory: Perimeter "Historic centre" according to P.R.G. of the city of Aquila, art. 52, Chapter IV of N.T.A .; Perimeter "Zone of range A", ex. art. 46 of P.R.G.; Perimeters of Reconstruction Plans; Scattered aggregates of historical- landscape interest.
2. The isolated historical-artistic buildings extra moenia: Religious settlements; Fortified settlements (fortified residence, castle, fort, fence, tower, fort, walls); Civil settlements with predominantly residential function (palace, villa); Industrial buildings no hydraulic power (furnaces, historic factories) (Fig. 2).
3. The water system and production facilities: Sources; The main waterways; Other waterways; Lakes; Factories hydraulic power (mills, paper mills,).
4. The historical paths, the agricultural landscape and the transhumance system: Sheep tracks; Historical viabilities; Bridges; The railway stations Aquila-Capitignano; Churches, granges, chapels along the sheep track; Settlements with agricultural function (farms, hamlets); Tholos; Caves; Houses and pastoral shelters; Fountains; Refuges (Fig. 3).
5. The archaeological sites: Italic settlements; Roman settlements; Amphitheatres; Theatres; Fortified enclosures; Catacombs.

In particular, the cards contain the planimetric identification of the artefact, the name, the type, the main historical data and a photographic repertoire. The latter, if inclusive of images before the earthquake, favors the comparison between the current state and prior configurations.

The Transformation Processes: Two Case Studies

Particular attention should be devoted to the analysis of the "transformation processes of historical settlement systems". Therefore, in the context of the urban reorganisation of the area, it is useful to develop, together with the 'Charter of the heritage', a careful 'Criticality Analysis' aimed at the preparation of the policy and regulatory apparatus, as the actions of heritage safeguard. Referring to the City of L'Aquila, the focus is:

- reconstruction interventions underway or planned (reconstruction Plans, Projects of urban-building restoration, reconstruction Projects of building aggregates);
- the phenomena of anthropic degradation, degradation because of abandonment, degradation due to damage and / or collapse owing to the earthquake; degradation resulting from the actions taken in the emergency phase;
- the architectural and urban residual values.

With reference to the analysis of the transformation processes and instances of heritage protection, two themes were explored with specific dedicated readings: the territory between the area A of historic center (referred to the current PRG of L'Aquila) and the perimeter of the city walls; the historic center of Arischia. The territory between the area A of L'Aquila's historic center and the perimeter of the city walls is regulated as restructuring area. This territory includes a building fabric related to the expansions of the first half of the twentieth century, with small villas in eclectic style, interesting purists and neomedieval episodes, examples of modernist architecture of the thirties and forties (Fig. 4). Within this area, many works have been carried out in the recent phase of reconstruction. As has been said, the examination of residual values has to be thorough since they can suggest appropriate safeguards addresses. The reconnaissance of the buildings has been conducted with handwritten cards. In particular, each card detects:

- identification of the building as part of its area of interest (area near the Villa Comunale, area near the Church of San Bernardino, other residual areas between the perimeter of the area A and the city walls);
- orthophoto that highlights the building in its urban context;
- photos of the comparison between the current configuration of the building and that before of the 2009 earthquake
- a summary sheet with information regarding the location of the building, its name (if existing), the architectural typology, the designer and the customer name (if known), the date, past transformations and the current function, notes that highlight the historical-architectural-typological features.

Through the census compared with similar studies conducted before the 2009 earthquake, it was possible to find the following case studies:

- collapsed buildings and not yet rebuilt

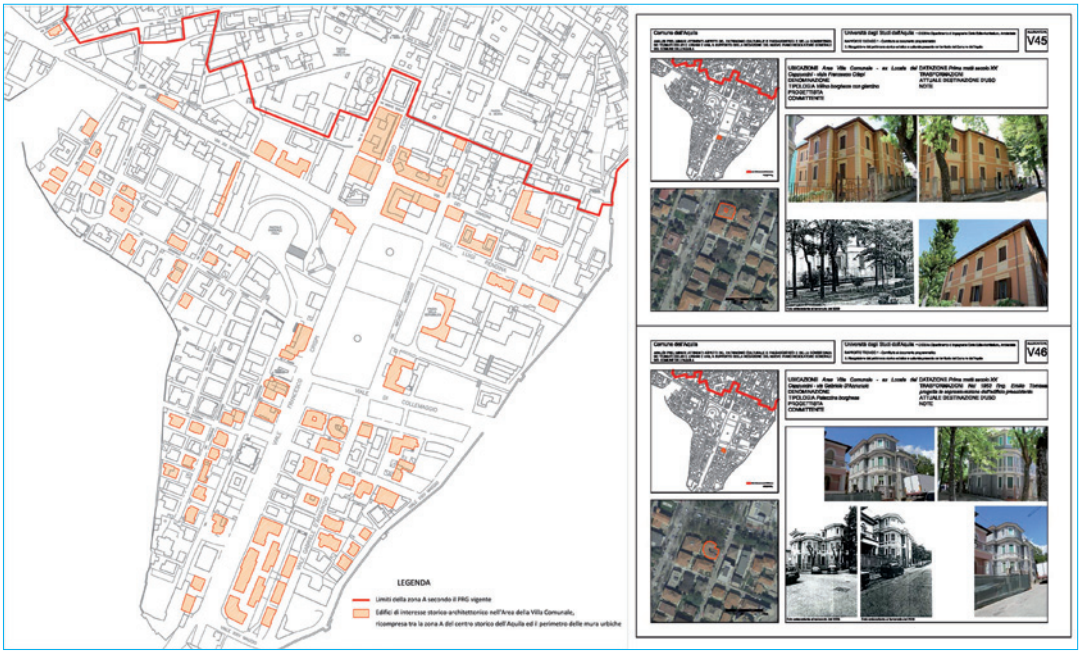

Fig. 4. Cards examples of buildings situated in the perimetric area of the historical centre of L'Aquila in the area of Villa Comunale (elaborated by Vittorio Lucchese)

- buildings demolished and rebuilt in analogy to the state before the earthquake
- buildings without important damages or which have not yet been subjected to interventions, which have preserved the formal and constructive values;
- buildings under repair.

Such situations must be specifically considered in the planning stage, so as to prepare regulatory instruments that ensure the preservation of the figurative, historical, architectural and testimonial values still present. The historic center of Arischia is the exemplar of all other minor historical centers of the municipality of L'Aquila. For these, the current PRG (1978) does not provide any protection provisions for the historic fabric, so much so that in the historical centers are possible interventions of building renovation, even demolition and reconstruction. In particular, the rather large historical center of Arischia still expresses the historical-typological values and a significant architectural language, such as the court house plants (for special features perhaps unique in the Apennine context), and "houses with profferlo" (Fig. 5). It is clear that the post-earthquake tragic condition presupposes a particular caution. Where the residual, typological, formal and figurative values allow even a proper reading, it is desirable that reconstruction plan combines the need for consolidation and renovation with the values of the pre-existence, both at urban structure level and at level of the building fabric.
Like the buildings situated in the perimetric area of L'Aquila's historic center, a reconnaissance was carried out with specific cards containing: the planimetric identification of the analyzed buildings; the orthophoto showing the building insertion in urban context; a current state photos, even in comparison with the pre-earthquake situation; summary information on the

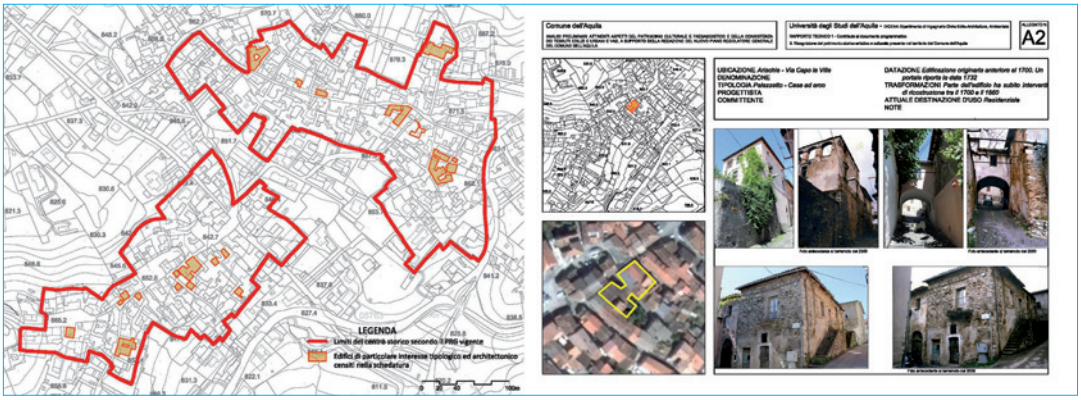

Fig. 5. Arischia historical centre: buildings of particular typological and architectural interest censused in cards (elaborated by Vittorio Lucchese)

location, the type, the presumed date and possible transformations. The census carried out has revealed several situations:

- cases where the architectural and typological values were preserved, because of the absence of interventions, or interventions with recognition and preservation of these values;
- transformations that did not definitively compromise the architectural and typology value of buildings, representing a further stratification in the various phases of construction;
- partial or total collapse in which the residual values are really minimum, linked to substantial states of ruin, probably not compatible with the maintenance in case of functional reinstatement of structures

In the planning phase, a standardization of the case studies is hoped in order to encourage the preservation of existing values.

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Abandoned Villas of Russian Nobles in Rural Landscape

Mariya Komarova[a]

[a] Politecnico di Torino, mariya.komarova@polito.it

KEYWORDS: Russian Empire, country houses and parks, architectural and cultural heritage, problems of conservation, prospects for reuse

ABSTRACT

The nobiliary villas of the Russian Empire have been recently considered in the strict sense as an essential part of the Age of Enlightenment. Noble estates with their main houses or palaces, parks, gardens, greenhouses and theaters of serfs, libraries and museums make up a large part of that culture. The architecture of country villas inseparably linked with their rural landscape as unique works of art. Together they make up what is called cultural heritage of Russia, with an equally brilliant history and the same tragic fate.

Introduction. Noble country estates in Russia: the history of blossoming and decline

The phenomenon of Russian manor lies in the fact that it has become a unique cultivation center of Russian national culture. The majority of Russian writers, scientists, politicians, composers, and travelers grew totally in the estates. In the countryside the villa was the center of an agricultural area with villages, plowed fields, pastures, meadows, forests, rivers and lakes. A striking example of such an independent economic unit with a complete architectural ensemble is the estate Otrada in the village Semenovskoe, one of the largest non-royal residences in Russia and the largest in the Moscow region. The first owner of the villa was Vladimir Orlov, who in 1766 was appointed director of the Academy of Sciences (Fig. 1).

Fig. 1. Unknown artist. View of the estate Otrada, the middle of the XIX century. Source: Russian State Historical Museum. Inv. 61807/K-64

Fig. 2. V. Polenov. Painting «Grandmother's Garden», 1878. Source: Retrieved 30 August, 2016, from http://www.tretyakovgallery.ru/ru/collection/_show/image/_id/2233

In 1714, Emperor Peter I issued a decree on the «real estate» which was based on the property of nobiliary lands, all of them were transferred by inheritance; the land could not be lost at cards or divided into smaller parcels. Through this law the Emperor tried to protect the Russian nobility from poverty. In 1762, a decree of Peter III of the «granting of liberty and freedom for the whole of the Russian nobility» finally liberated nobles from compulsory service, extending their possessors rights.

There was a general strengthening of "privileged class" and at the same time its advanced part, – honored nobles and favorites, won a lot. Their great wealth was created by "awards" of the inhabited estates. The value of noble estates was determined only by the number of serfs. The notable youth of that time has been already widely and comprehensively brought up abroad, studying philosophical sciences and taking a great interest in art. Under Catherine II the mastering of European culture became stronger. Aesthetic culture of the Russian nobility in the late 18th century was particularly high. Annually transports of precious artistic items were conveyed

from abroad by sea and drove by endless roads in different directions landlord Russia at great risk of damage and loss. Houses and manors presented the whole treasury of all branches of art. Priceless art collections, libraries, scientific collections were gathered there. Country villas of imperial favorites stood out notably, they didn't only not inferior to what was done at that time in Western Europe, but sometimes even superior to them in its grandiosity.

Balls, festivals, masquerades, performances, gala dinners with music lasted whole days and ended with illuminations and grand fireworks. The fashion, the luxury and the habit of imitating the imperial court absorbed enormous amounts of money. These funds constantly replenished from the proceeds of the estates.

The liberation of the serfs in 1861 gave rise to the rapid death of the former culture, the ideal of which was – "life for life" and "service to science and art". The whole aristocratic culture that was created and developed thanks to the gratuitous labor, in the late 18th and early 19th centuries reached its dizzying peak, but collapsed with the abolition of serfdom. There wasn't enough money to support it by wage labor; the splendor quickly created just as quickly disappeared. (Gornostaev, 1914)

Painter V. Polenov in 1878, 17 years after the abolition of serfdom, created the painting «Grandmother's Garden» (Fig.2). Here the grandmother and the granddaughter are the main characters – as the symbols of the outgoing and the new era. The house is a background of the scene; it is a typical noble house of that period, with a plaster and decorative details already flown away. The path leading to the house looks also abandoned. The garden expanded on the both sides of the lane supplements the feeling of neglect. This landscape is not just scenery, but the main participant of a picture and displays changes in society. The monuments value of vanished life was realized at the time only by persons involved in the arts.

Basic principles of studying Russian villas

In the early 20-years of the 20th century in public the broad understanding of the artistic beauty of Russian manor finally appeared. December 22, 1922 in Moscow, a group of researchers headed by V. Zgura (1903 – September 17, 1927) organized the first SSRM (Society for the Study of Russian Manor). In principle activities, the Society advanced the history and problems of Russian architecture of the XVIII and the first half of the XIX century of the monuments of country residences.

SSRM implemented and deployed a systematic and comprehensive study of "Noble Nest" and made a significant contribution to the study of Russian culture of XVIII-XIX centuries. Starting from 1923, the members of SSRM produced and published studies and measurements of the most important monuments of manor architecture (Ostafyevo, Olgovo and others). Their works were published in the journals **«** Sredi kollektsionerov **»**, **«**Podmoskovnye muzei**»**, **«** Sbornik Obshchestva izucheniya russkoy usadby **»**. The first printed edition (Zgura, 1923) described the methodology of the research work of the Society. The research was divided into the following sections:

I. Architecture. II. Gardens and parks. III. Theoretical questions. IV. Theater. V. History and life. VI. Painting and sculpture. VII. Applied art.

The work of the first section represented the most valuable material of the history of Russian architecture. Here it is possible discover a completely new and unexpected types of structures; fascinating data about transformations of manor architecture, reflections and distortions of style, as well as its evolution. The Society was also interested in arts of serfs and in the art of architectural rural landscape, etc. In 1923 for convenience and more successful organization of the SSRM a division of the whole territory of the Soviet Republic by the manor districts with their centers was adopted, where there were authorized members of the Society in charge of the entire district. There were seven districts:

I. Moscow region (province of Moscow. Center – Moscow).

II. Central region (provinces of: Tver, Smolensk, Kaluga, Tula, Ryazan, Orel, Kursk, Tambov, Voronezh, Penza, Vladimir, Yaroslavl, and Kostroma. Center – Moscow).

III. Volga region (provinces of: Nizhny Novgorod, Kazan, Simbirsk, Samara, and Saratov. Center – Kazan).

IV. North region (provinces of: Petrograd, Novgorod, Pskov, Vologda, Vyatka, Perm, and Arkhangelsk. Center – Petersburg.).

V. South region (provinces of: Kiev, Poltava, Kharkov, Ekaterinoslav, and Kherson. Center – Kiev).

VI. West outlying region (province of: Mogilev, Minsk, Zhytomyr, and Kamenetz-Podolsk. Center – Minsk).

VII. Crimean region (peninsula. Center- Crimea).

All scientific activities of SSRM were divided into two parts: research and elaboration. At the initial phase of the work of the Society, the material on Russian manors was very limited. The main focus had to be given to inspection and fixing; this work was assigned to the summer season, which was entirely occupied by the survey, describing and photographing the major

Fig. 3. N. Podklyuchnikov. Manor Ostankino of Sheremetev family, 1836. Source: Shchusev Museum of Architecture. Retrieved 30 August, 2016, from http://archi.ru/russia/image_large.html?id=186775

monuments. Travels, explorations and expeditions were carried out in this connection. The Society paid the most serious attention for photography and the accumulation of photography and drawing archives, which, together with the card catalog it became the most important scientific capital. All efforts were applied to the search for pictures of no more existing monuments. The architectural structures of interest were measured and drawn, that was the most valuable contribution to science. At the end of 1930 the activity of SSRM was ceased due to changes in the social-political situation in the country and was resumed only in 1992. Now it is an unregistered Russian historical and educational association of local historians, both amateur and professional art critics involved in the study, in the description and the promotion of the culture of the ancient Russian manor. Members of the Society make their posts with many photos and archival extracts in internet and in online social networks.

Noble estates situated in the rural landscape of Moscow region

In 2005, the Heritage Institute in collaboration with the non-profit partnership «Russian manor» developed a map of noble villas in Moscow region based on materials of A. Chizhkov. The map shows cities, former county towns, rural settlements, roads and estates with an indication of residences and utility buildings, manor temples, parks and names of the same villas. According to the catalog (Chizhkov, 2002), there are 644 fully or partially preserved villas only in the Moscow region. Manors are presented by districts in alphabetical order. An information block belonging to each country estate contains a summary of the history of the monument, the owners, and the number of structures and features of the garden and park area, the state of today's preservation. The type of Russian noble villa was finally formed by the end of the XVIII century. The main house flanked by outbuildings, gardens and utility courts became its center. There was a gradual

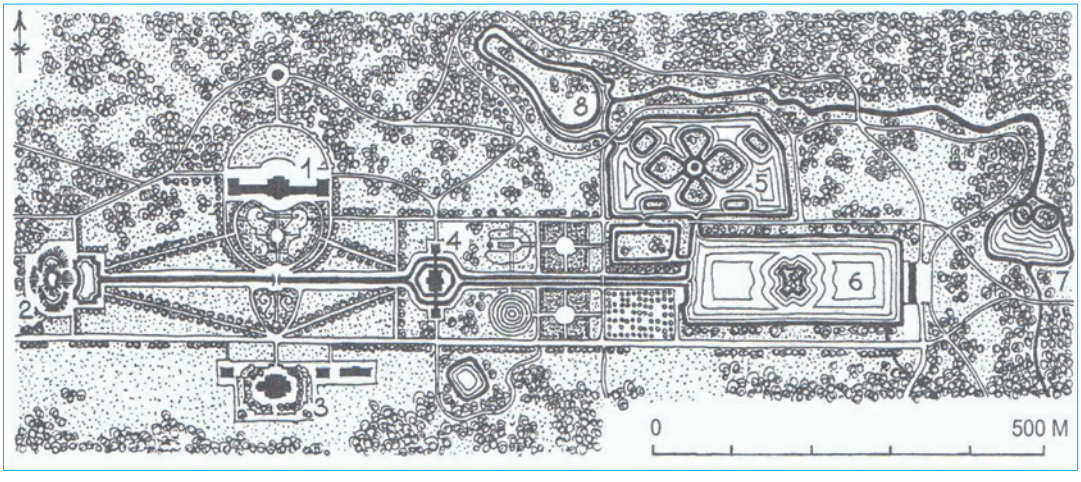

Fig. 4. Almazovo. The end of the XVIII – the beginning of XIX centuries. 1-Manor Houses; 2 – Mount Zion; 3 – The Church and the clergy house; 4 – The House on the Island; 5-Swan Pond; 6 – The Big Pond; 7 – Triangular Pond; 8 – The Menagerie. Source: Ozhegov, 2003, p. 153

accumulation of experience in the construction of stone residential buildings, displacing traditional wood. Artistic principles of baroque and classicism are mutually enriched and complemented each other. There were new elements of the garden in the form of regular, clear geometric shapes of flower beds, ponds and fountains. Manor gardens started with regular "French" parterre (cour d'honneur'), adjacent to the house and passed into the "English" landscape park. The sizes and compositions of estates varied endlessly. In the simplest of them "French" part could be referred as flowerbed, and "English" park limited to the clearing glade in front of the house opening onto a view of it. Large estates, owned by a wealthy aristocracy, in its scope and luxury palaces approached of neighborhoods of St. Petersburg. These include estate Otrada of Count Orlov (Fig. I), the manor Ostankino of Counts Sheremetev (Fig.3) now is in the limits of Moscow city.
The main elements of such estate is the manor house and the church, standing, usually on a high place. Alley, ponds or river with the indispensable pavilion over it every time were included in the composition with a new unexpected idea. Much attention is paid to the architectural ensemble, which is subject to layout of the garden. A group of trees geometrically clipped serves as a harmonious continuation of the architectural masses. Tracks performed by ruler and compass, they form a variety of geometric shapes, sites and confusing "labyrinths". They are bordered by clipping trees

Fig. 5. Villa of merchant Aigin before and after restoration. Source: Retrieved 30 August, 2016, from http://ru-travel.livejournal.com/32085725.html and from http://deadokey.livejournal.com/15619.html

in distant "perspective", and sometimes consist of long, shady hidden track, or "arched corridors". The geometric form with elaborately lined beaches also was attached to the ponds and canals. Sometimes this garden was divided in the form of ledges or terraces with stone stairs and slopes, with a barrier of balustrades decorated with rows of antique statues, busts and vases. There wasn't a single tree in these fine gardens being remained in its natural form; all elements are subordinated to the artistic idea, remodeling and adapting nature to the refined aesthetic and decorative forms. Another interesting system of Landscape Park is located in the estate Almazovo of nobles Demidov in Moscow region (Fig. 4). At the end of XVIII – early XIX centuries a group of architects and gardeners, headed by V. Tkachev created there a unique composition of ponds and canals. Mount Sion was sprinkled on of the ground, obtained after the digging of ponds. Such mountains, named also Parnassus, were ordinary fashion tribute to the romanticism of that time.

Problems of conservation and prospects for reuse of country noble villas. Conclusion

Now in Russia, there are about 7000 villas of nobles, which are monuments of architecture and history, only one third of them is not in ruins. Italian architects Rasstrelli, Giraldi, Rinaldi, Quarenghi, Camporesi left their big names here. The desire to conserve the landscape, to reconstruct the historic environment of architectural monuments more and more clearly revealed. The memorial parks occupy a prominent place in a circle of green areas for special purposes. Many of them could be regarded as parks and museums destined to preserve the sites associated with great people and events. There are museum-reserves in Boldino of Aleksandr Pushkin, in Melikhovo of Anton Chekhov and others. The Russian Historical Society developed a number of proposals for an integrated approach to the restoration of destroying monuments in Russia. It was considered the possibility of privatization of the abandoned villas of nobles for one ruble; new owners could restore them and open access to tourists. The proposal was supported in the initiative of private entrepreneurs and investor companies. In Moscow region they started to restore several estates: a manor Olgovo of nobles Apraksin, manor Pushchino on Nara of princes Vyazemsky, manor Cherkizovo of princes Cherkassky. The villa of merchant Aigin in the village Talitsy has been already restored and has a function of hotel complex (Fig. 5).

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Cultural Itineraries in "Grecìa Salentina": a Virtual Tour of St. Stephen's Church in Soleto (Lecce)

Paola Durante[a], Alberto Giammaruco[b], Sofia Giammaruco[a]*

[a] IN-Cul.Tu.Re. Project, Lecce, Italy – paola.durante15@gmail.com sofiagiamm@gmail.com
[b] CRESCo Soc. Coop., Lecce, Italy – algiamma@gmail.com
*Corresponding author

KEYWORDS: Sustainable enhancement, virtual tour, webgis, open data, cycle tourisme itineraries, Salento region

ABSTRACT

The research and social innovation project "IN-CUL.TU.RE. Innovation in Culture, Tourism and Restoration" took place in the complex territory of the "Union of Municipalities of Grecìa Salentina", in the heart of the Salento region. The objectives of the project were to represent and promote knowledge and enhancement of the cultural heritage of Grecìa Salentina, through non-destructive diagnostic tests for restoration and conservation, energy efficiency, development of ICT tools for territorial enhancement.

One of the outcomes of the project was the compilation of thematic guides which cover three cycle tourism itineraries and include multimedia contents.

Another tool for the representation and sustainable use and knowledge of the analysed territory is the IN-CUL.TU.RE. website, www.inculture.eu. The website has a WebGIS that – through open data – provides access to the results of the research undertaken.

Thanks to the collaboration of the IT-Lab of the IBAM-CNR of Lecce, an augmented reality tour was developed: the virtual tour of St. Stephen's in Soleto (http://www.inculture.eu/chiesadisantostefano/). The user is accompanied through a knowledge path which allows him or her to see the invisible, including technical data. Other enhancement activities were presented through photography, video art and documentary.

Introduction

The following article describes some of the results achieved in the framework of the research and social innovation project "IN-CUL.TU.RE. Innovation in Culture, Tourism and Restoration" which won the Ministry of Education call for proposals "*Smart Cities and Communities and Social Innovation*".

IN-CUL.TU.RE.'s intervention took place in the complex territory of the "Union of Municipalities of Grecìa Salentina", in the heart of the Salento region which is characterized by the presence of a minority language, known as *griko*.

The objectives of the project were to positively impact the promotion and economic development of the area and to represent and promote knowledge and enhancement of the cultural heritage of Grecìa Salentina. In order to achieve these objectives, a network of cultural assets that testify to the historic and structural identity of the area was identified (landscape; architectural; archaeological; artistic and intangible).

For each of the twelve case studies identified which best represent the researched area, a number of multidisciplinary research programmes were planned. These covered three the-

Fig. 1. An interactive map and accompanying thematic guides provide an introduction and overview of the region (Picture by A. Giammaruco, 2016).

matic areas: non-destructive diagnostic tests for restoration and conservation; energy efficiency; development of ICT tools for territorial enhancement.
The twelve pilot projects took place in collaboration with public institutions and private entities, particularly the IBAN-CNR of Lecce, the Laboratory for Non-Destructive Diagnostic Tests of the Turin Polytechnic, the ISMB of Turin and the CRESCo cooperative. Collaborating with the territorial offices of the MiBACT, as well as the active involvement of local public and private actors was fundamental for the project's results.
Please find below an overview of some of the concrete outcomes achieved for the sustainable promotion and development of the cultural heritage of Grecìa Salentina.

ICT instruments for knowledge, use and sustainable enhancement of the area

One of the outcomes of the project was the compilation of thematic guides which cover three *cycle tourism itineraries* (Fig. 1). The guides include multimedia contents which reference the results and discoveries of the multidisciplinary research conducted within the scope of the project. The objective of the guides is to contribute to the strengthening of the cultural offer of the area, as well as promoting a conscious and sustainable use of the analysed territory.

The itineraries are available online and in hard copies. The hard copies feature an interactive map- thanks to five QR codes- which provide an overview of the visited region in English and Italian and additional special contents. The online version includes digital storytelling; multimedia maps; virtual tours in augmented reality.
The three guides (*Olive trees, oaks and "furnieddhi"; Biking through Grecìa Salentina to the sea; Walking around historical centres in Grecìa Salentina*) are accompanied by another publication, *Travel recommendations,* and GPX data which allows the user to access the itineraries through their GPS device.
Another tool for the representation and sustainable use and knowledge of the analysed territory is the IN-CUL.TU.RE. website, www.inculture.eu. The website has a *WebGIS* that – through *open data* – provides access to the results of the research undertaken, thematic pages on case studies and information on activities including photographic exhibitions and documentaries developed throughout the project. These tools provide heterogeneous and original content – both scientific and narrative – which allows users to effectively gain awareness of the researched territory (Fig. 2).
The WebGIS, which underlines once again the complementarity between research activities and territorial enhancement, includes a number of layers which provide information on the researched cultural assets as well as on the cycle tourism itineraries.

- The "researched cultural assets" layer allows the user to read and download all the materials produced throughout the research, including technical-scientific files and monographic publications in digital format.
- The "thematic itineraries" layer underlines the focal points of the presented itineraries and allows the users to read and download the relevant guides and special contents, for example the "Travel recommendations" guide and the GPX itinerary data.

The maps presented on the site are based on open source resources that are globally available such as Open street Map, and regional maps available on http://www.sit.puglia.it/ (for example, the Hydrogeomorphic Map, the Technical Regional Map and Ortofoto 2013).
The decorative and iconographic style of the church of St. Stephen in Soleto makes it one of the most important examples of late Gothic painting in Puglia. Choosing to investigate on a cultural asset of such importance provided a means to enhance the surrounding territory, too. A multidisciplinary study conducted on the asset through non-invasive diagnostic tests (IR Termography surveys and micro-XRF analysis) allowed to deepen knowledge of the asset. Thanks to the collaboration of the IT-Lab of the IBAM-CNR of Lecce, we developed an augmented reality tour: *the virtual tour of St Stephen's in Soleto* (http://www.inculture.eu/chiesadisantostefano/).
The user is accompanied through a knowledge path which allows him or her to see the invisible, including technical data that is usually limited to specialised environments which – thanks to the developed system – become user friendly and accessible in an interactive and effective manner.
The main output is a HTML5 app compatible with PC and smartphone which includes a gyroscope functionality that can be activated on-site and remotely (Fig. 3). The starting point was

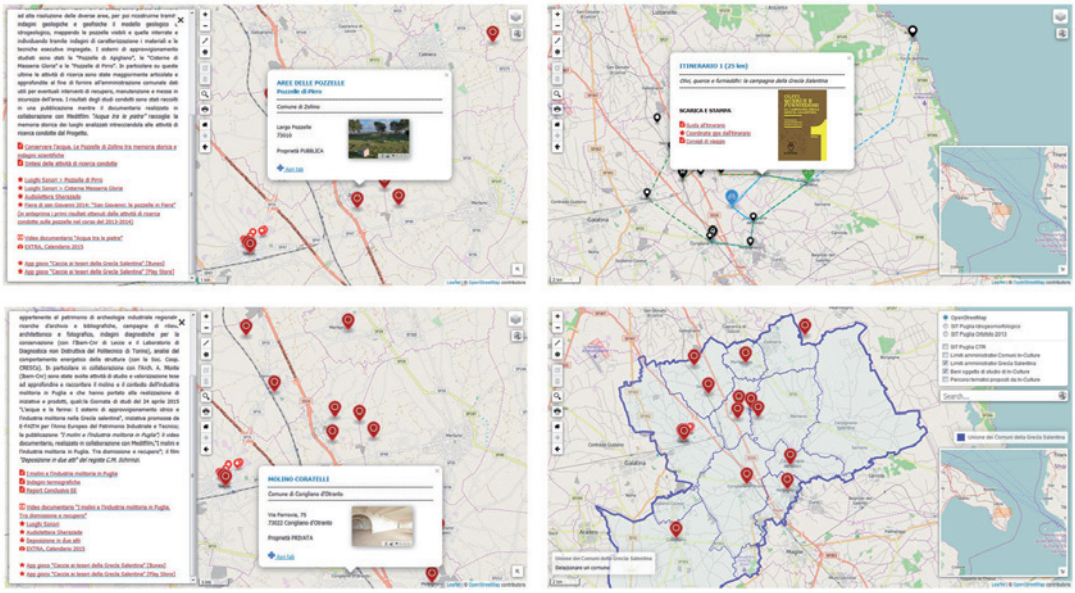

Fig. 2. A WebGIS complements the research results with the tools developed for territorial enhancement (www.inculture.eu/mapleaflet/inculture_gis.html#).

the creation of a 3D model of the church through laser scanner surveying, digital photogrammetry and high-res mapping of pictorial cycles. The 3D model also includes miscellaneous contents which provide a complete and diachronic overview of the monument. The virtual model provides information divided in thematic sections: a film contextualizes the monument in the history of art, and for each cycle a guide provides a description of the iconography of the frescoes. The system also allows the user to learn about the techniques adopted for the decoration of the cycles, and some frames allow to visualize elements of virtual restoration. The outcomes of the diagnostic research undertaken throughout the project are included in two specific sections: one dedicated to the IR Termography, and the other to the Portable XRF technique.
Advertising for the St. Stephen's church virtual tour is present on a number of levels; this is included in the IN-CUL.TU.RE. website as well as in the cycle tourism itineraries.

Knowledge, representation and enhancement of the territory through other researched assets

Le Pozzelle (which can be loosely translated into 'tiny wells') are an example of rural architecture which is present in almost all of the municipalities of Grecìa Salentina. These are structures built for the collection and conservation of rain water – concentrated in hollowed areas – which are a testament to the transformation that man has imposed on landscapes throughout time. The multidisciplinary study conducted on the Pozzelle of Zollino through the project IN-CUL.TU.RE. ranges from the recovery of the historical memory through the

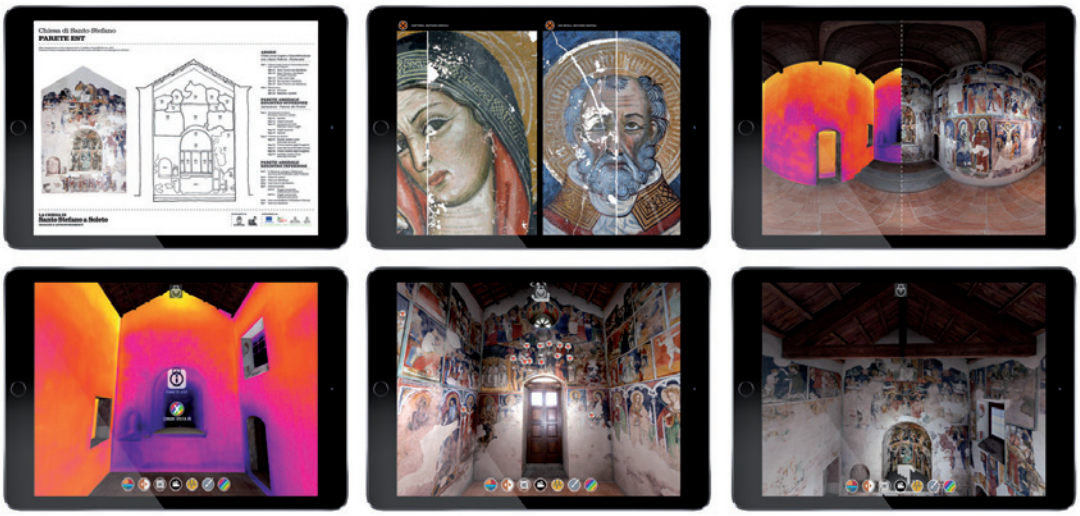

Fig. 3. Some elements of the virtual tour "St. Stephens' in Soleto". From top left and clockwise: iconographic reading; virtual restoration; superimposition of termograms on the 3D model; localization of the 70 analysis points of the pictorial decoration; navigation of the 3D model, from unusual points of view and in detail, thanks to the high res mapping (http://www.inculture.eu/chiesadisantostefano/).

involvement of the local community to the establishment of a technical base aimed at the planning and design of interventions to enhance and recover the assets. This process is described in the publication *Conservare l'acqua: le pozzelle di Zollino tra memoria storica e indagini scientifiche* (Fig. 4). The research developed for this case aims at establishing a practice that can be replicated in similar contexts.

The virtual model of a *pozzella* and the other digital surveys undertaken on the researched assets in collaboration with researchers from the IT-Lab of the Ibam-CNR of Lecce constitute

Fig. 4. The results of the research project were distributed free of charge to communities and cultural institutions. These are accompanied by innovative techonlogical tools, for example apps and virtual tours (Picture by A. Giammaruco, 2016).

precious tools for the knowledge and study of these structures, and are useful for raising awareness and the sustainable development of the territory.
The *Apigliano Archaeological Park* demonstrates the stratified settlement of the Salento territory and is home to a Bizantine and Medieval village which has been the subject of research of the University of Salento since 1997. In collaboration with the Medieval Archaeology Laboratory of the University of Salento, a publication called *Apigliano. Un villaggio bizantino e medievale in Terra d'Otranto. I reperti* was developed alongside an *augmented reality* system available through an app (http://www.inculture.eu/parcoarcheologicoapigliano/). The objective of the publication and app is to raise awareness of the park through the use of innovative technology; in doing so, these products provide an accessible history of a village in Medieval Salento to the public at large (Fig. 4). The *Coratelli Mill*, built throughout a number of historical periods and unused since 1991, hosted the production of the company R.Coratelli and V.Imparato since 1920. This cultural asset belongs to the *archaeological industry heritage* of the Region of Puglia, and it bears witness to the development of the mill industry that took place in the region from the second half of the XIX century. IN-CUL.TU.RE. studied the mill through archive and bibliographical research, architectonic and photographic surveys, diagnostic conservation surveys, analysis of the energy component of the structure, and activities aimed at the promotion and enhancement of the mill. This case study provided the starting point for the publication *I molini e l'industria molitoria in Puglia* developed in collaboration with the architect Antonio Monte (Ibam-Cnr Lecce) and Meditfilm. The publication – in addition to a monograph and a documentary – provides a deeper reading of the mill industry in Puglia (Fig.4).

Other enhancement activities

Other enhancement activities which allowed for a unique representation of Grecìa Salentina were presented through photography, video art and documentary (Fig. 5).
- *photo features and exhibitions*: photo feature *We were in Salento and didn't see the sea*; exhibitions *From here, there is no sea – the landscape of "Grecìa Salentina"* and *Possible futures. The landscape of "Grecìa Salentina"*; 2015 calendar *Between Visions and Paradoxes. "Grecia Salentina" by Piero Marsili Libelli;*
- *audiovisual products*: film short *Deposition in two acts* by Carlo Michele Schirinzi; *I molini e l'industria molitoria in Puglia. Tra dismissione e recupero* and *Acqua tra le pietre* by Meditfilm.
The *Sherazade app – Storymaker for travelling* is a digital storyteller which allows users to listen to voices and stories of the place surrounding them through their smartphone. Audiostories and audioletters accompany the user in the discovery of 12 cultural assets of the IN-CUL.TU.RE. project through the voices of imaginary characters who narrate significant and unique aspects of the region.
Auditory Places is an initiative promoted by IN-CUL.TU.RE. in collaboration with the Cooperative CRESCo with the objective of analysing the acoustic characteristics of the analysed case studies, with a focus on reverberation. The adopted technique is the Convolution Reverb, an audio

Fig. 5. The language of photography, video art and the documentary were used as tools to read and narrate the Grecìa Salentina landscape (Picture by A. Giammaruco, 2016).

elaboration that, starting from the recorded response of an impulse in a given place, produces a new audio file that contains the reverberation of the environment. This allows to appreciate how a place can influence and modify a sound. The corresponding experimental platform developed for this purpose (available at http://www.inculture.eu/luoghisonori/) represents yet another tool to promote and enhance the territory, because it allows to upload a piece and listen to it by applying the typical reverberation of the chosen places out of the 12 cultural assets of *Grecìa Salentina*.

Conclusions

With the strategic objective of uniting touristic appreciation and cultural heritage, the project allows users the opportunity to visit and know a "different" part of Salento, which goes beyond the coastal areas and the "mass" folkloric events present during the summer period. *Grecìa Salentina* therefore becomes "an island in the peninsula", a hinterland which is historically and culturally rich and which can be visited and discovered year round.

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Achieving Impact: Benefits Gained by Both Archaeologists and The Communities in Whose Landscape They Work

Patricia Duff

☞ MA (Cantab) FRSA, Division of Archaeology, University of Cambridge, UK, ArchaeoLink – Info@ArchaeoLink.org

✔ KEYWORDS: impact, outreach, engagement, archaeology, education, tourism, wellbeing, stakeholders, Elefsina, Eleusis, Troina, Vela Luka, Vela Spila.

ABSTRACT

Achieving impact is becoming more and more important in our world today.

ArchaeoLink was established at the University of Cambridge to liaise between archaeologists and the communities in which they work to assist those communities to obtain educational, economic and societal benefits from their sites. Our guiding principles are to promote archaeology, heritage and historic landscapes, and current research within this area, as sources of social and economic wellbeing and cultural development. The key to successful impact lies in the involvement of diverse stakeholders within the local community and in assisting them to shape and realise their objectives.

Before discussing why Impact should be achieved and how it could be achieved, it is important to understand what is actually meant by Impact. There exist all sorts of definitions and buzz words: community outreach; public awareness; giving back; positive impact... However, for the academic, Impact is the result of taking one's research, or elements of it, into the public sphere. (Fig. 1) Impact is the outcome of sharing research with the general public. Indeed, Impact is a key factor which the Research Councils UK now take into account when assessing the value

Fig. 1. What ...? -Impact is the result, the outcome of sharing your research with the non-specialist.

of research: where societal and economic impact is described as the "demonstrable contribution that excellent research makes to society and the economy" (RCUK, 2014). Furthermore, many funding bodies insist that applications carry an element of community outreach within the proposal: an Impact Statement has to be completed (RCUK, 2016).
The reasons why concern with Impact has arisen relate to ethical considerations and the value of sound knowledge exchange with a variety of stakeholders. The European Charter for Researchers: General Principles and Requirements state, "Researchers should ensure that their research activities are made known to society at large in such a way that they can be understood by non-specialists... direct engagement with the public will help researchers to better understand public interest." (EU Charter, 2005). Promoting non-specialist understanding can lead to their obtaining educational, economic and societal benefits. Benefits flow both ways, promoting the value of knowledge exchange and bringing information; co-operation; site conservation and funding to the researcher (Little, 2012).
Archaeology is well placed for achieving impact as it is multi-disciplinary, bridging arts and sciences, thus offering the potential for varied and multi-faceted layers of interest (Bastow et al, 2014). The identification of and engagement with stakeholders, before, during and after a project, builds trust and encourages co-operation and contribution. This involvement of and investment by stakeholders is a guarantee to sustainability (Dabphet.S) Understanding and mediating stakeholder expectations and comprehending how our work may affect them, is key to success. (Fig.2) Thus interpersonal skills are vital; it is important to remember that not everyone is a good communicator.

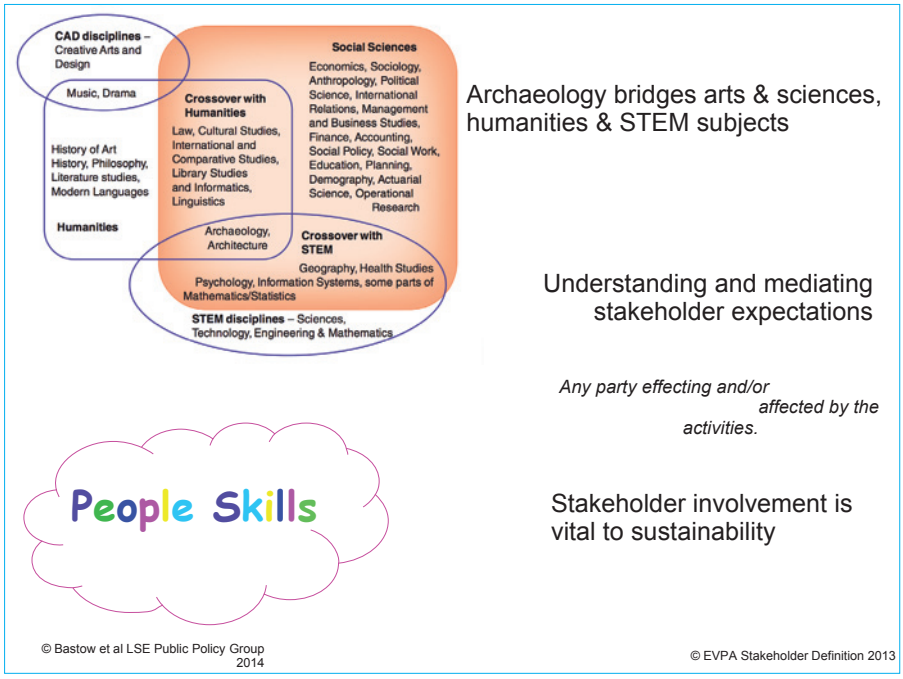

Fig. 2. Archaeology... - Multi-disciplinary archaeology is ideally placed for achieving Impact.

While academic publication is the traditional route for achieving Impact, ArchaeoLink looks at practical ways of achieving direct impact with project stakeholders and beyond. While each project is unique. Impact can be achieved through any or all of three pathways: social interaction; education; economy. But, creating and delivering these pathways to Impact is only part of the story. The expectation, as stated in the Research Councils UK Pathways to Impact, is that Impact is demonstrated: it needs to be measured. Again while each project is unique, there are strategies for obtaining both quantitative and qualitative data which will help to show how the research is impacting the public.

Case Studies

Elefsina, Greece

ArchaeoLink was asked by the Initiative of Cultural Heritage, from the University of Canterbury, to assist the community in Elefsina, Greece, to gain more benefits from their site: Eleusis. This important sanctuary, dedicated to Demeter & Persephone, renowned for the Eleusinian Festival, was once as important, or more so, than Delphi. Now it has few visitors whereas Delphi enjoys 1/2 million tourists a year. While not wishing such an increase, the stakeholders wished for Eleusis to be better known, locally, nationally & internationally.
Following an assessment, ArchaeoLink presented a number of recommendations, (Fig.3) The first was the formation of a Friends of Elefsina association: vital as the volunteer base for putting

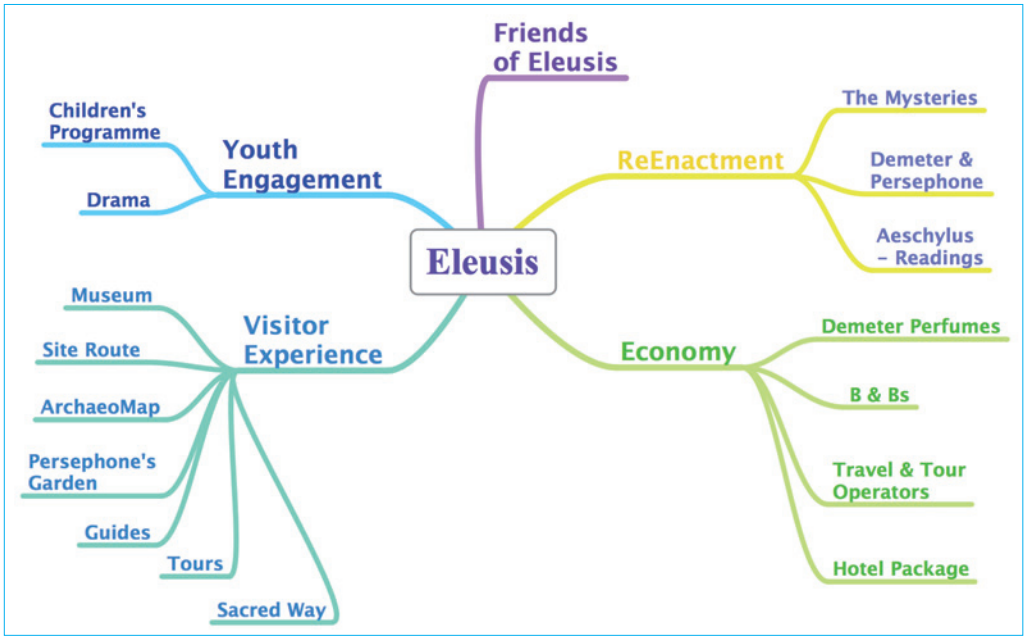

Fig. 3. Recommendations... - Suggestions for the Elefsina stakeholders.

several of the ideas into practice. Among these we wrote an Education ArchaeoResource Pack for educators & children; helped organise live readings (by volunteers) of the Homeric Hymn to Demeter; and initiated Persephone's Garden, another point of interest for visitors, designed by students from the local agricultural college with flowers & plants mentioned in the hymn.
Friends of Elefsina was established in June 2013. They had 200 people at their first meeting and 184 at their second; they have a Facebook page of events with over 2000 'likes'; and they held a major conference on Eleusis in 2014. In 2015, we took a couple of members to visit a self-funded arts centre in the UK to understand the model in more detail; they then started something similar in Elefsina's disused buildings. Furthermore, after publishing an article in Current World Archaeology, ArchaeoLink encouraged two international tour operators to include Eleusis in their itineraries. In 2016 the town announced their candidacy as a European Capital of Culture for 2021. (Fig.4)
Thus the outcome, the Impact, is that archaeological and heritage information is being distributed in the community; visitor numbers are monitored and increasing; special interest groups are now visiting and increasing touristically related income, broadening the economic platform.

Fig. 4. Elefsina - These activities furthered local and international interest in Eleusis.

Troina, Sicily

ArchaeoLink worked in association with Cambridge and Belfast universities Troina archaeological project as the Mayor wanted to re-energise and regenerate the mediaeval hilltop area of his town. A social group was not recommended, as many already existed, but the appointment of a cultural liaison officer was suggested to act as a fulcrum between the groups.
At the Mayor's request, members of the archaeological team had mounted 7 cases of finds for the museum. ArchaeoLink has planned an interactive museum programme as well as assisting with information panels, a time-line and brochures.
On discovering some 12,000 people from all over Italy attend a nearby medical centre annually; ArchaeoLink recommended certain strategies for encouraging and facilitating their visits to the mediaeval centre.
The area is picturesque and has natural resources; ArchaeoLink advised on practices for attracting special interest groups to visit.
These, (Fig.5) together with the Mayor's initiatives of facilitating more exhibitions to attract summer visitors and to sell abandoned properties for €1, should encourage more visitors and assist in the regeneration of the mediaeval centre.

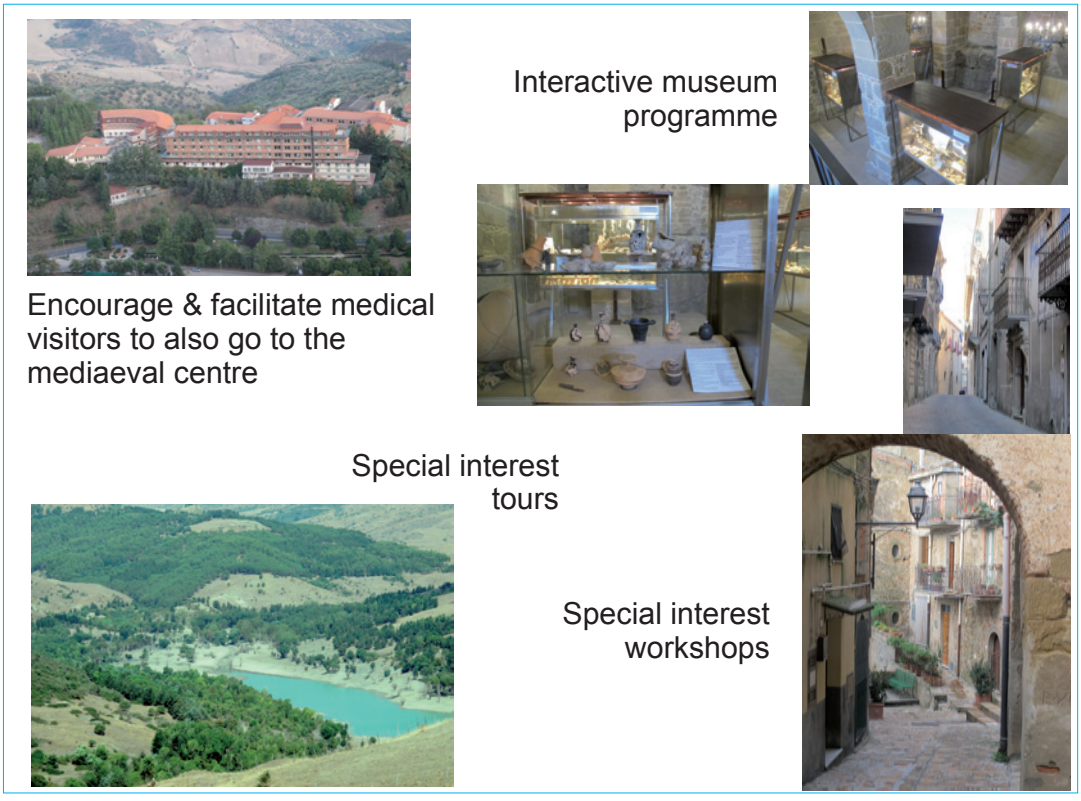

Fig. 5. Troina - The recommendations should re-vitalise Troina's mediaeval centre.

Vela Luka, Croatia

ArchaeoLink is working with the Universities of Pisa, Zagreb & Cambridge, whose research is focussed on Vela Spila, a site with an occupation stratigraphy of 25,000 years, 120m above the seaside town of Vela Luka. The cave, impressive for its size, is visually very attractive, with two large openings in the roof providing light. It has an abundance of finds. These tell stories of volcanic events, climate change, sea level change, early ceramic figurine making from 17KYA, husbandry & advanced fishing practices and rituals from the pre-historic.
Vela Luka has a July & August tourist season based on family holidays. The community wishes to extend the season and benefit from the uniqueness of their archaeology.
ArchaeoLink has already assisted in making marketing and site information brochures. We plan to have non-specialist articles published and to have various cruise companies encouraged to stop at Vela Luka and to visit the cave. We are currently working on a site-specific Educators' ArchaeoResource Pack for school children and a Guide's Training Programme for school leavers. We are helping to establish a Young Archaeologist's Club and, on our next visit, we will help the organisers run a week-end workshop excavating test-pits in public places. (Fig.6) This will give training to youngsters who could perhaps assist archaeologists as well as encourage local interest within the community.

Fig. 6. Vela Luka - Youthful enthusiasm spreads to parents and visitors to expand and lengthen the season.

Achieving Impact is becoming more and more important in our world today as knowledge exchange between researchers and non specialists is recognised as being crucial and of immense value to both.
It is necessary to show a clear pathway, particularly in funding applications, to achieve it, as well as strategies for its demonstration. Just as vital are the people skills to follow the pathway and interact with specialists and non specialists, to achieve the desired educational, economic and societal Impact.

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Alpine Refuges as Devices of Sustainable Development For High Lands

Riccardo Giacomelli

☞ Department of Civil, Environmental and Mechanical Engineering
University of Trento, Italy 28-29 August 2016

✔ KEYWORDS: Alps, Refuges, Network Strategy, Sustainable Tourism, Cultural District, Smart Landscape, Mountain Innovation

ABSTRACT

In the evolutionary framework of the meanings that in the past man has attributed to the high lands, from cruel nature [G. Leopardi, 1836] to place of the sublime, from playground of Europe [L. Stephen, 1871] to sensitive ecological system to defend, it was investigated the sustainable exploitation of the potential of high altitude alpine areas. The inaccessibility of some cultural and geological sites, the necessary safeguard measures of hotspots flora and fauna, and the dispersion of the previous values in large territories both in a geographical and altitudinal sense, are conditions that today can limit the punctual fruition and knowledge of many aspects of the Alpine palimpsest, but have a key role in the enhancement of sustainable tourism in the high lands. The analysis carried out on the GIS platform, using open access data, investigated the mountain territory of Trentino region, giving each of the 146 refuges a significant part of territory gravitating on the structure within which identify relevant cultural and environmental values. Research has led to the construction of a systemic and strategic scenario of the refuges as key actors for a High Altitude Cultural District for the mountains of Trentino.

Introduction

The becoming of the forms of communication and fruition of culture and information is rapidly changing the paradigms of decoding and promotion of both intangible and material aspects of all consumer goods, from electromagnetic devices to cultural heritages. The possibility to reproduce a precise documental data through various forms of restitution, (geographical coordinates, relational databases, three-dimensional models, ...) has led to the construction of many digital archives, available on demand, at relatively accessible costs. Today this digitized cultural heritage, through the diffusion of individual mobile devices with web access, lends to find new forms of interaction between user and documental data, with different degrees of interactivity between the material reality of a precise data and the numerous digitized information that refer to it. The same digital nature of the data, for some types of information assumes a hybrid value between the material data and its interpretation, as in the case of a design or a three-dimensional reconstruction of a place at different times. In this regard it is necessary a precise project of communication and construction of the information data, able to reveal the spatio-cultural context that generated it, useful for future analysis of the evolution of the construction and communication of digital information, with similar characters to what is now commonly done in the practices of the relief and restoration of the physical heritage of the past.

Software-culture and hardware-landscape

The physical disjunction between material data and user, which is connected to the process of computerization, as well as the kaleidoscopic return of the same through the different visions and skills of renderers, is a very important component in the communication of elements and areas with lower physical accessibility (such as private properties, caves, places disconnected from the networks...), rather than cultural facilities connoted by the prevalence of the immaterial dimension instead of the material. This heterogeneity of sources is linked and interrelated in the process of digitalization, which, in fact, builds an augmented reality available to the user, whether it is accompanied, or not, to the physical dimension of the documental data. If the fruition of a digital data itself is independent from where the user is located, the synergy between physical reality and digital superstructures assumes an important value in the promotion and communication of the territories, both for the local communities, that can build real collective memories, and for the other users of territories, who can easily become aware of the opportunities for the territories and give to wishes their direction. In this regard, the computerization of the characters of a territory, may turn out to be central referring to its promotion and its repositioning on tourist markets, through the possibility to aggregate to great attractors already present in the territories a cosmic structure of evaluation, otherwise difficult to be communicated to the final user. Within this framework it is therefore possible to design processes of exploitation of physical places, which can be activated through a digital information superstructure, in the form of cultural districts and intelligent landscapes.

The network metaphor

By the term network we can identify a physical or virtual device characterized by a series of specific elements, called nodes, mutually interrelated to each other through connectors. The

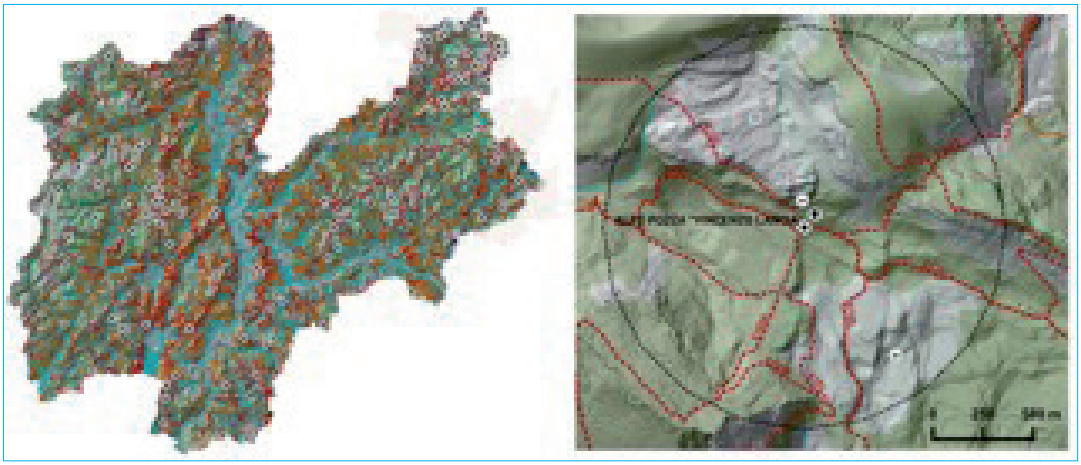

Fig. 1. The network of alpine refuges in Trentino and the disconnection between physical network of accessibility and the one of environmental and cultural values. (Giacomelli R.)

nodes-connectors relation is the logical and geometrical basis within a number of elements, even mixed together, can be considered a network. If for the virtual world the connections between punctual elements can always be established, with limited energy input, leading to the networking of all the available information, in the physical world, the issue of accessibility is a strong discriminating element for the fruition of a large number of cognitive elements. The historical answer to the impossibility to make on-site use of environmental contexts, for example, was in the time assigned to the pictorial and views arts, while the communication of archaeological ruins was often entrusted to museums, that can take care of its communication and conservation aspects. The museum institution, in its nature, establishes a distance between object and context, and implement a targeted selection of the communicable data. These limits have been understood by the local communities, which naturally intended to give an answer through the establishment of small museum realities and documentation centers of the territory, able to specialize on particular thematic and territorial areas, as a form of enhancement of its specificities. The limits of these structures are in some ways similar, even if with a different scale to those of the main museums, to which, however, they add further criticalities in management and renovation.
In this frame emerges that the communication of cultural and environmental values, today fundamental in the request and in the fruition of the territories, can be more effective through the establishment of digital superstructures, easily upgradable and capable of establishing a better interactivity with users, to be attached to communication poles widespread and accessible on the territory.

Resew physical networks with digital devices

The reality of the high lands is a morphologically complex space, inhabited by man since the Ice Age (about 13500 BC), which is characterized by a limited possibility to establish connections, derived from the shape and the nature of the hillsides. Forms of interest that man has in the past attributed to the mountains are varied and constantly evolving, moving from inhospitable place to sublime space, from playground of Europe [L. Stephen, 1871] to ecological system to defend.
The signs left by man over time at high altitude are many and tell us the different forms of human activity and the different settlement reasons. The types of signs are very different from each other, from cave paintings to the melting furnaces, from the alpine necropolis to the traces of prehistoric settlements, from the fortifications of the Great War to the artifacts with artistic and cultural value. They reassume the very meaning of human presence in the high lands and define a unique cultural palimpsest of great interest for the cultural promotion of these territories. The limit of this heritage is inherent to its cosmic structure, connoted by a large dispersion of buildings on extended territorial areas, often characterized by limited accessibility and disconnected from the main crossing paths. In these particularly sensitive contexts the main ways of crossing and access are derived from climbing and hiking practices,

then linked to the optimization of the mountain upward mobility dynamics, in its meaning of goal to be achieved, rather than of the seat of numerous cultural and environmental valences to interrelate. The physical connection network of paths, if by one side presents a planning limit with respect to the networking of cultural values, should be considered as a physical invariant with respect to the territories. It is in fact hardly extensible from a physical point of view, both for the realization and maintenance costs, and for the cultural inappropriateness to build new tracks inside natural areas with high flora and fauna value.
These basic conditions suggest the opportunity to explore other reconnection dynamics of cultural and environmental values for the high lands, which integrate the digital network to the physical one, to increase the attractiveness. In this regard it is appropriate to specialize the physical network, attributing for the proximity the cultural and environmental values of their geographical contexts, and then by identifying the physical structures able to communicate in a traditional form the characters of those places.

The case study

The research investigated the potential of promotion and communication of environmental and cultural values of mountain regions of the Autonomous Province of Trento, a tourist province in northern Italy characterized by a mountain orographic structure in its entire extension, without any connection to the sea. This condition has brought over time the Trentino to the construction of its tourist market through the mountain product, in its double summer / winter seasons [M. Franch et al, 2012-2013].
Within this tourist reality that was consolidating since after the second world war, now makes feel the need to start rethinking the tourist offer, both for the changed environmental sensitivity towards the mountain, and for the growing problems related to the gradual rise of average temperature, and the resulting reduction in snowfall during the cold season. The broader seasonality of cultural tourism and sustainable tourism, could supplement the consolidated offer of mountain product in Trentino [L. Betta and L. Tomaselli, 2006] in the form of a Cultural District of High Lands. It was then carried to the large-scale analysis with geomapping tools, then deepen through multi-scale models, on the physical network of the High Lands in whole Autonomous Province of Trento, suitable to investigate the main components such as the network of Presidios, the network of accessibilities, the hydrographic network and the landscape systems. Similarly, have been recognized at high altitude the punctual cultural, geological and environmental valences, then related for proximity reasons to the physical networks of access to mountain systems. The gap between digital and physical network of the valences was mediated by allocating and reporting a limited number and geographically defined values to a class of territorial attractors spread in given territories. It was therefore considered appropriate to identify a class of pre-existing attractors recognizable by the user (Fig. 2), such as infrastructure already close to environmental issues and proper of the mountain culture: the mountain refuges (Fig. 1). These accommodations, deriving from the practices of

mountaineering and hiking, ensure a wide coverage of Trentino's mountain territory, offering a kind of understated hospitality already coherent with the principles of sustainable tourism, for which the cultural and environmental integration of territorial offer can be placed as a supplement income to ensure the overall process sustainability of exploitation and its further developments.

Fig. 2. The refuge Sette Selle in Val del Laner, Trentino, Italy, 1977 m a.s.l. (Giacomelli R.)

The device refuge

The alpine refuge is a basic accommodation, whose main role is to act as the local presence in the mountain areas which are isolated from transportation and major communications networks. This structures are characterized by minimal services and spaces, for which usually the user is sharing with strangers to him both day and night spaces [G. Azzoni and P. Mestriner, 2013]. On the management plan the refuges guarantee the opening only in the summer season, the historically suited to hiking and mountain climbing, but more frequently many structures are starting on a voluntary basis to propose an extension of the seasonality linked to a territorial offer that has to be lived with slow times, less hectic than the large tourist's numbers in summer and winter seasons for the accomodation included in the ski areas [L. Bolzoni, 2000 and 2001]. Research has therefore intended to evaluate the possibility of extending the role of these structures from territorial Presidio [L. Gibello, 2011] to cultural Presidio, identifying in the localization of this accommodations a surplus value for communicating the environmental and cultural valences of these specific alpine areas. For each refuge (Fig. 3) in Trentino have reappeared specific valences of cultural, geological and environmental interest, through the construction of spatial isochronous centered in each structure and was then tested the

possibility to improve the attractiveness of the same structures assessing the predisposition to build synergy networks with other refuges, the possibility to extend its accessibility to new forms of sports users (such as bikers, canyoning, ...), the possibility to increase the comfort for new forms of users and finally are suggested guidelines for a better inclusion in landscape of structures with respect to future renovations [A. De Rossi and R. Dini, 2012].
The alpine refuge therefore acts as a key for physical interface between the physical network, not fully accessible, and the digital one, through the communication of the different aspects that significantly characterize the setting of its territorial presence, not only through the keys of interpretation of mountain climbing and hiking, but also of culture, archeology, geology and environment.

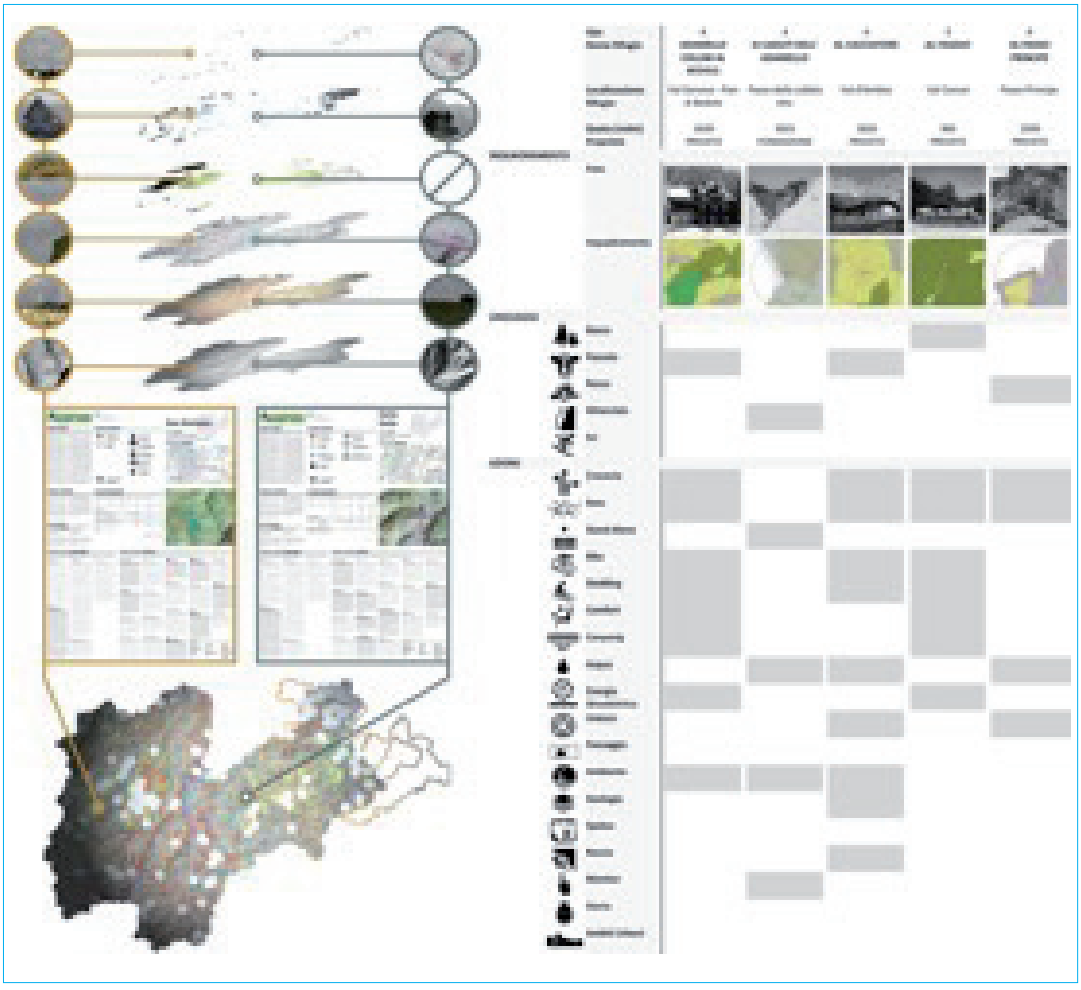

Fig. 3. The attribution of cultural and environmental valences to the refuges of the Province of Trento and its restitution in form of abacus. (Giacomelli R.)

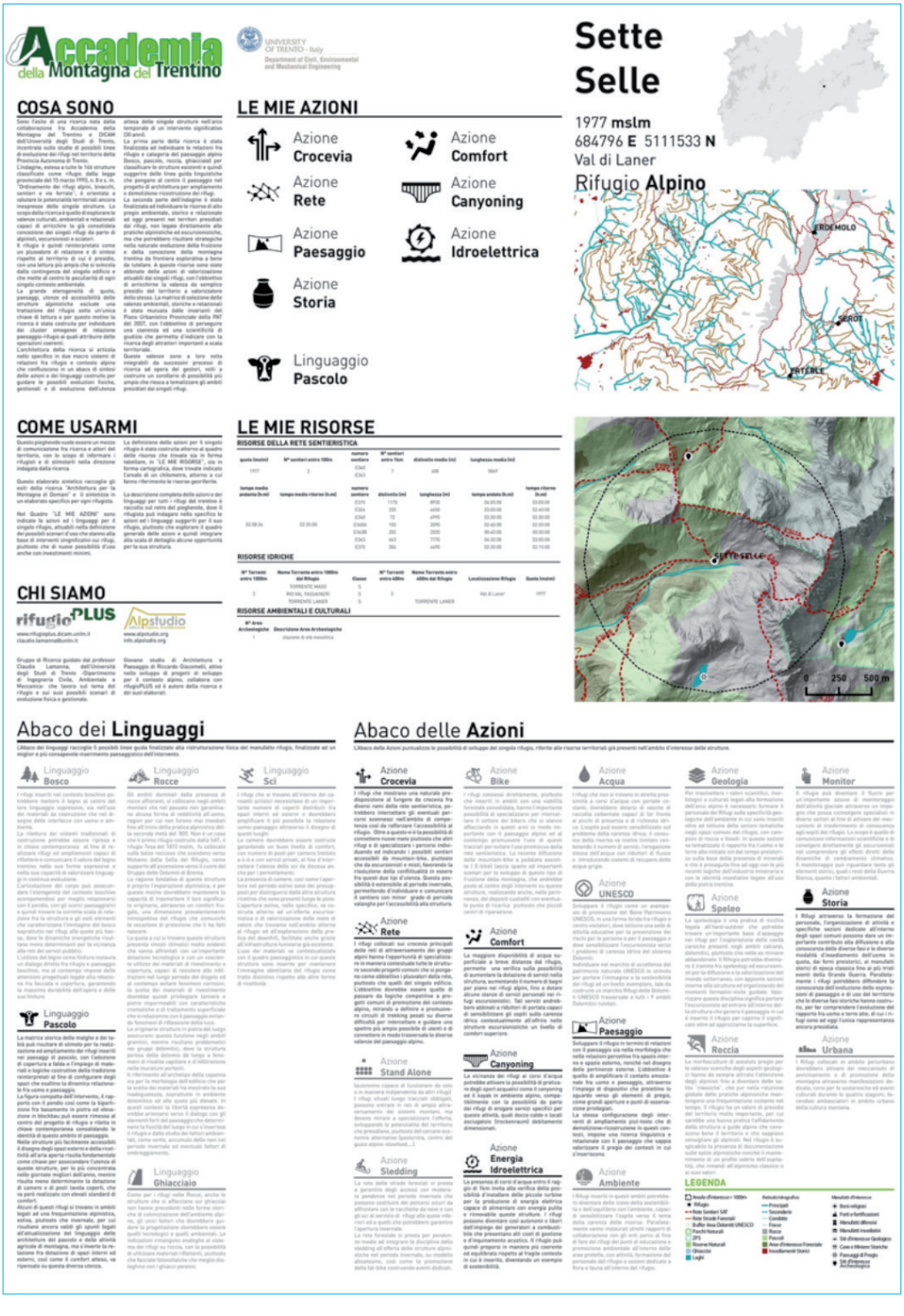

Fig. 4. An example of an action board distributed to the refuge managers of Trentino. (Giacomelli R.)

Results and outcomes

Research has led to the recognition of the networks of values present in high altitude territories already manned by Trentino's Refuges. The archaeological, historical, cultural, ecological and geological valences have been selected for proximity and then communicated with physical and/or digital devices from each refuges. On this given basis you can have a coherent view of the potential for development of sustainable tourism and cultural district of all refuges in the Province of Trento, with respect to which you can plan specific actions on the single structure, rather than areal strategies.
From the point of view of the property of the 146 Trentino refuges [L. Betta and L. Tomaselli, 2006], they present a complex panorama divided in Alpine Clubs, Public Institutions and Individuals, for which it was intended to produce an action board (Fig. 4) for each refuge, which summarizes the results of the research on the single accommodation. These sheets were presented and distributed to all managers of Trentino refuges during the Annual Assembly of the Association of Trentino's Refuges as a form of sharing knowledge and incentive for individual entrepreneurs towards a new vision of its own structure in the key of cultural district and sustainable tourism. It was then launched a second step of the research in collaboration with the Foundation Academy of the Mountain of Trentino and the Association of Trentino's Refuges, to check on the project plan different application scenarios of the Action Board on some sample cases.

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Archaeoilogy: a Spatial Data Infrastructure For The Integrated Management of The Historic Landscape and Heritage Related to Olive-Oil Production in Calabria (Italy)

Salvatore Di Fazio*, Giuseppe Modica, Carmelo Riccardo Fichera

☞ Università "Mediterranea" di Reggio Calabria, Dipartimento di Agraria, Reggio Calabria (Italy) (salvatore.difazio@unirc.it; giuseppe.modica@unirc.it; cr.fichera@unirc.it)
*Corresponding author

The olive landscape can be considered as the most typical agricultural landscape in the Mediterranean basin. In Southern Italy it relates to a very old tradition in the production of olive-oil, which is today a most valuable product. Calabria is one of the main Italian olive-oil producing regions. Here olive groves have documentary evidence since the 8th century B.C., when the region was a Greek colony, while olive-oil production knew significant technological advance in Roman times. Since then the regional agricultural landscape has progressively become a stratified cultural landscape, rich with the many material and immaterial historic signs related to olive-oil production. These signs today mark the regional identity of the produce. In the same olive landscapes they still can be found: archaeological remains of the old Greek and Roman settlements; century-old gigantic olive trees, which in some areas densely populate the countryside so as to form sort of olive forests; traditional olive-oil mills housing olive-crushing machines, presses, and processing systems which are very similar to those used in Roman times; early-industrial olive-oil mills (18th- early 20th centuries) documenting the evolution of processing systems in relation to the change in technological paradigmas and machine driving systems (hydraulic, steam, electric) (Di Fazio, 2011).
In Calabria, up to a recent past, the protection of the historic agricultural landscapes and buildings, including the heritage of agro-industrial archaeology, were perceived by farmers as in opposition with the need for agricultural innovation and efficiency increase. Today people's cultural attitude has changed. The search for agricultural sustainability and the spreading in rural areas of new forms of cultural tourism centred on farm-based heritage have driven farmers to recognize the importance of a sensitive valorization of the signs of the past, particularly those which can strengthen the marketing image of the local products and attract visitors. On the basis of these considerations, it was carried out a research aimed at defining strategies for the integrated management of rural landscapes. This, so as to promote present olive-oil production jointly with the valorisation of the archaeological heritage, old olive-oil mills and other resources showing significant potential to support farm-based services for cultural tourism.
In order to facilitate the access to all the geospatial data and analysis produced, and to share them with stakeholders and decision makers, a spatial data infrastructure was developed in a FOSS4G (Free and Open Source Software for Geospatial) environment. FOSS4G products are characterised by a large user base and development community that offer a high quality code base (Moreno-Sanchez, 2012).

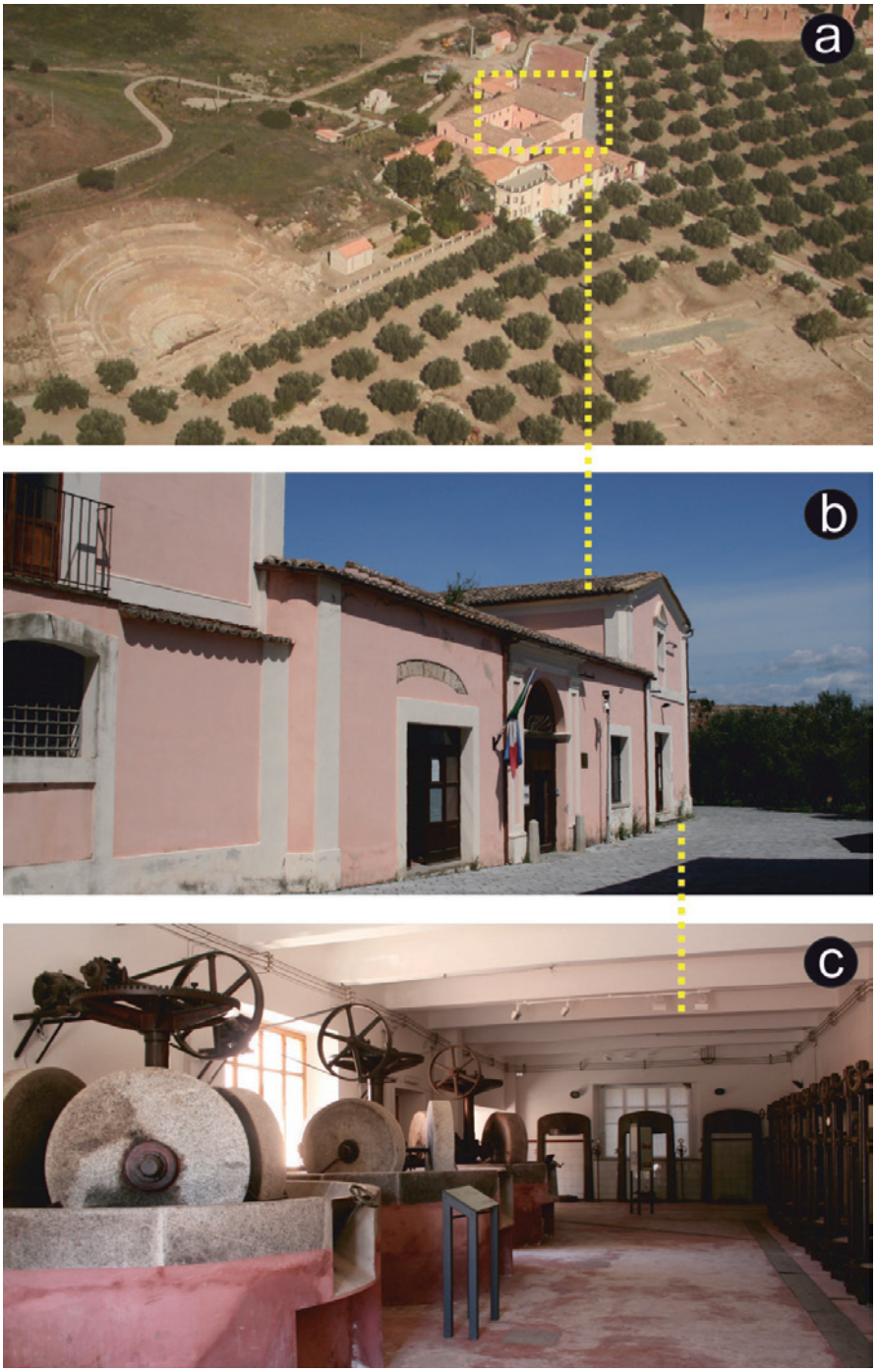

Fig. 1. The archaeological park of Scolacium, in Roccelletta di Borgia (CZ). The archaeological remains of the ancient greek-roman town are immersed in an old olive growth (a). Here the archaeological museum is partially housed in the old farmstead (b). Adjacent to it, an old olive-oil factory (early 20th century), can now be visited as an interesting example of industrial archaeology (c).

In more details, we adopted a Spatial Data Infrastructure implemented in an ongoing research, and characterised by a multi-tier architecture composed by three layers with different functions:

- A Data repository stratum to store data and metadata in a geospatial database developed in PostgreSQL with PostGIS extension;
- A Server stratum, composed by GeoServer and GeoNetwork Opensource, to manage stored data and metadata and publish them on the web using Open Geospatial Consortium (OGC) standard interfaces;
- A Client front stratum (i.e., the WebGIS client platform) developed in Heron Mc framework, to provide a graphical user interface to view and analyse data.

All produced geospatial data and reference base-data can be exposed as OGC standard interfaces, web map services, web feature services, web coverage services in the provided WebGIS platform that allows for browsing, zooming, identifying and querying the data and maps (Modica et al., 2016). These will help support: the definition of strategies for the sustainable management of the historic agricultural landscapes identified; the interpretation of their present condition and change trends; the definition of territorial infrastructures for the integrated management of the agro-industrial built heritage, relevant archaeological sites and the production facilities.

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Via Corduba – Emerita. Digital documentation in The *Ager Mellariensis*

Antonio Monterroso Checa[a], Massimo Gasparini[b]

[a] Dept. of History of Art, Archaeology and Music, Córdoba University, Spain
[b] DICEA, Dept. of Civil and Building Engineering and Architecture, Polytechnic University of Marche, Ancona, Italy

KEYWORDS: Archaeology, Photogrammetry, Remote sensing, Roman road, *Corduba*, *Augusta Emerita*, *Mellaria*

With a length of 144 Roman miles (about 214 km), the ancient *Via Corduba -Emerita* linked directly the two capitals of the Provinces of *Baetica* and *Lusitania*. The route of this ancient road is known for its presence in the Antonine Itinerary and in the Ravenna Cosmography. Since 2014, the Córdoba University promoted a series of studies about this important road, with the aim of documenting the known structures preserved to the present day, and to identify, with using modern methods of remote sensing, the exact path of the *Via* in the land of "Alto Guadiato" (ancient *Ager Mellariensis*).

It was therefore decided to proceed following two distinct lines of research. Regarding the documentation of preserved road infrastructures, we started a close-range photogrammetric survey on a stretch realized excavating the sandstones of geological formation of Sierra Morena – north of Córdoba -in the area known as "Lomas de los Escalones", still in use as a hiking route.

The rugged orography of the area and the dense wooded blanket prevent the use of UAV systems (Ummaned Aerial Vehicle). It has been therefore necessary to resort to a compromise solution, which could be economically advantageous and harbinger of good results.

It was decided to carry out a photogrammetric survey at ground level, using a telescopic rod of fibreglass and placing at the top a DSLR camera Canon EOS 1100D (APS-C sensor with a resolution of 12.2 mpx), without encountering problems of stability.

The photos are taken at a height of about 3.5 m, with a focal length of 18 mm (28.8 mm equivalent to 35mm format), ISO 100 and F-stop 8, in order to ensure a good ratio between speed of execution and quality of the survey. The examinated areas are also the subject of topographical survey: before the phase of images capture required for the photogrammetric processing, Ground Control Points are placed to the ground and these ones are detected by a total station TopCon OS 103. In this way, it's possible to reference all the photographs at the same local reference system and this allows the correct scaling and orientation of the point clouds generated by the automatic data processing. The Ground Sample Distance of the obtained point cloud is 1.5 mm / px.

From the upper left corner: Google Earth image with the route of *Via Corduba-Emerita* and the most important towns along its path; orthoimage from the point-cloud of a stretch in the area known as "Lomas de los Escalones" (Sierra Morena, Córdoba); thermal imaging with the

route of the roman road (highlighted in red) in the area of the *municipium* of *Mellaria* and in the near modern town of BŽlmez.
The second line of investigation, as mentioned previously, focuses on detection of the path of the ancient Roman road in the land of "Alto Guadiato", through the use of combined different remote sensing techniques.
The first stage concerned the aerial survey of an area of 2000 hectares and by this one it was possible obtain orthoimages and thermal images at different resolutions – realized in different weather and temporale conditions –; the second stage focuses on the execution, above some areas of particular interest, of most-detalled aerial and thermal imaging through the use of UAVs.
The instrumentation used for the remote-sensing surveys consisted of a thermographic camera FLIR SC655 (resolution of 640x480 pixels, focal-length 13.1 mm and F-stop 1.3. The analyzed spectrum of light is in the range of 8-12 µm) and of a digital reflex camera Nikon D800E (fullframe RGB sensor with a maximum resolution of 36.3 mpx).

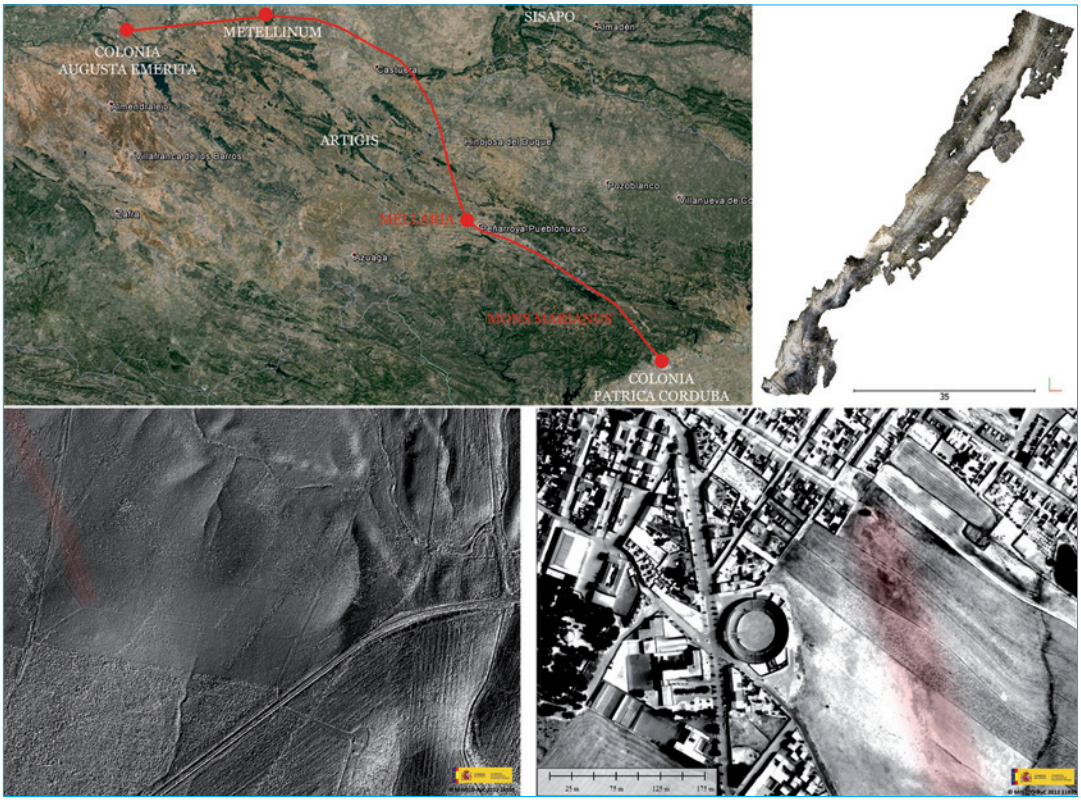

Fig. 1. From the upper left corner: Google Earth image with the route of Via Corduba-Emerita and the most important towns along its path; orthoimage from the point-cloud of a stretch in the area known as "Lomas de los Escalones" (Sierra Morena, Córdoba); thermal imaging with the route of the roman road (highlighted in red) in the area of the municipium of Mellaria and in the near modern town of Bélmez.

The orthorectification and composition of photomosaics were performed by applying photogrammetric methods based on Structure from Motion technique (SFM). It was possible obtain thermal mosaics in Kelvin degrees and with a spatial resolution of 0.37 m / pixel, high-resolution orthoimages and digital surface models (DSM) with a spatial resolution of 0.036 m / pixel. Thanks to the information deductible from the combined interpretation of the orthoimages and of the DSM, it was possible to detect some stretches of the ancient *Via Corduba-Emerita* scattered in the *Ager Mellariensis* and, until now, totally unknown.
These techniques, combined with traditional aerial oblique photographs, have allowed to reach a greater knowledge of this Roman road. The use of such methods is bearing both as scientific support, both as a database for the implementation of future applications regarding the archaeological and natural heritage of the ancient *Ager Mellariensis*, the current "Alto Guadiato".

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From Frasassi Gorge to The Via Flaminia. Real and Virtual Dimensions of The Local Area and Its Museums

Gaia Pignocchi[a], Alessandra Panzini[b], Francesca Serpentini[c]

[a] Archaeologist and Independent Researcher; e-mail gaia.pignocchi@libero.it
[b] Marchingegno srl, Ancona; e-mail progetti@marchingegno.it
[c] Freelance tour guide, main contact for Museum of Genga – Art, History and Territory; e-mail francescaserpentini@alice.it

KEYWORDS: Local context, Genga, Frasassi, upper Metauro valley, archaeology, geology, palaeontology, wider cultural heritage, sharing, multimedia systems

The area surrounding Frasassi Gorge in the municipality of Genga is unique not only for the great diversity of its landscape and environmental features, but also for its rich assortment of cultural heritage assets (museums, monuments, as well as archaeological, historical, environmental and geological sites). Beginning with this area, our aim is to present a feasibility project involving a wider area, not only administratively speaking, but, more importantly, in terms of the local context and environment. In doing so, we will consider certain aspects of history, culture and identity that are held in common and will include (physically or virtually) areas which, whether in the past or in the present, have shared the same features in terms of landscape, environment and history.

On this basis, we can identify a series of unique (exclusive and singular), yet shared themes running through certain local areas, upon which to create a narrative and further develop the assets that the wider area has to offer.

Places, finds and museums, all to be discovered on a trail built on individual and collective experience linked to several fundamental concepts:

- discovery
- recognition of values
- rarity and uniqueness
- knowledge
- involvement
- sharing.

The opportunity provided by technologically innovative instruments is very important in this process, provided they are part of a uniform strategy to promote and present cultural heritage and they are used within a system of integrated governance.

The area concerned stretches from Frasassi Gorge, created by the Sentino River, near the Umbria-Marche Apennines, as far as the upper valley of the River Metauro and its tributaries, the Candigliano and the Burano. In Roman times, the latter waterways marked the route for the Via Flaminia consular road, which partly followed ancient routes travelled in pre-protohistoric times. Other roads were laid along other now secondary routes, whose use continued in the centuries following the disintegration of the Roman Empire.

In this paper we present some of the evidence from before and after the Roman Era, the period we are most familiar with, in order to share this extraordinary heritage which, although perhaps more difficult to identify and uncover, has enormous potential (Fig. 1).

Fig. 1. Frasassi Gorge and Furlo Gorge, in the upper valley of the River Metauro, two areas which, whether in the past or in the present, have shared the same features in terms of landscape, environment and history.

The purpose is to gather and show the community the extraordinary heritage of Frasassi and draw attention to the relationship it has with other areas that are linked to it, such as those in the Apennine section of the upper Metauro valley.
In addition to acting as places of storage and display, museums should play a more active role as centres of documentation, dissemination, and communication, whereby they can inform their users and promote culture, education and tourism, as well as actively promoting local development. Starting from this assumption, therefore, it would be helpful to create a network of dynamic relations between various local contexts.
The town of Genga is home to two museums in the space of just a few square kilometres. The Museum of Speleology, Palaeontology and Archaeology is housed within San Vittore alle Chiuse abbey. Within its walls, visitors can follow the trail of the fundamental stages in the history of geology and humanity. Genga's new Museum of Art, History and Territory is housed in one of the historic residences of the counts of Genga, within the walls of the homonymous

castle. This museum's sub-name is "From the Venus of the Palaeolithic Era to the Madonna with Child", signifying its aim to document, through two important and evocative pieces, the continuity between prehistoric forms of worship and Christian veneration that is evident in the various manifestations of archaeological and artistic heritage, in an area where the relationship between the sacred and the landscape is particularly close (Pignocchi 2014).
Recently installed in the Museum of Genga is a new technological device created by the research group DiStoRiHeritage headed by Professor Paolo Clini of the Department of Civil and Building Engineering and Architecture of Marche Polytechnic University in Ancona, in partnership with EVE – Enjoy Visual Experiences – an academic start-up of the same university. The purpose is not only to create high definition reproductions of the Palaeolithic Venus of Frasassi, but also to provide several levels of information. This approach is not only visually engaging, but also didactic and informative. It consists of a 3D screen showing in detail one of the extraordinary archaeological finds of Frasassi, the Venus figurine. Using the new technology, this find can be the starting point for interactions with other finds, other contexts and museums, involving man and the local area in the broadest investigative and emotional terms.
Several themes can be seen as the common thread running between Genga and the upper valley of the Metauro, from the geological to the paleontological, the archaeological and the art-historical, all featuring the landscape and the vicissitudes of nature and humans. This is an inextricable relationship shared by areas which, in different eras, were chosen for their environmental and natural attributes, particularly suited to various activities, and whose evocative force stems from the interaction between the unspoiled landscape and the events that have taken place over time and can still be evoked.
One counterpart of Genga and Frasassi can be found in the upper Pesaro district. In the town of Cantiano, the GeoTerritorial Museum and the Museum of Archaeology and the Via Flaminia, dedicated to Giulio Cesare Corsi, have several themes in common (AA.VV. 2002; Marchegiani, Pignocchi 2007; Pignocchi 1999).
First is the very close relationship that exists between geology, the local context and man. This is particularly evident with Marta and Ugo, two marine reptiles that have enabled the reconstruction of the environment in the Mesozoic Era from 250 million years ago (Fig. 2). The two reptiles tell us of continental drifts, the formation of the sedimentary rocks that make up the skeleton of the Apennines, the process by which living species, in this case reptiles, adapt to swimming (Marta) (de Marinis, Nicosia 2000) or marine locomotion (Ugo). Two unique but overlapping testimonies, which should be known, represented and fostered in a narrative that unfolds down the ages.
Other unique paleontological finds include the specimens of *Ursus spelaeus* found in the Grotta del Mezzogiorno cave in Frasassi and the Grotta degli Orsi cave on Monte Nerone, whose remains are on display in the Museum of Speleology and Palaeontology of Genga and the Brancaleoni Civic Museum of Piobbico (Fig. 3).
The species became extinct around 25,000 years ago in the Upper Pleistocene Epoch and was known to the *Neanderthals* and the first groups of *sapiens sapiens*.
Both of these areas were inhabited in the prehistoric era (Pignocchi 1999; Monacchi 2004), from *Neanderthal* Man to *homo sapiens sapiens*, and both saw the widespread use of flint, a raw

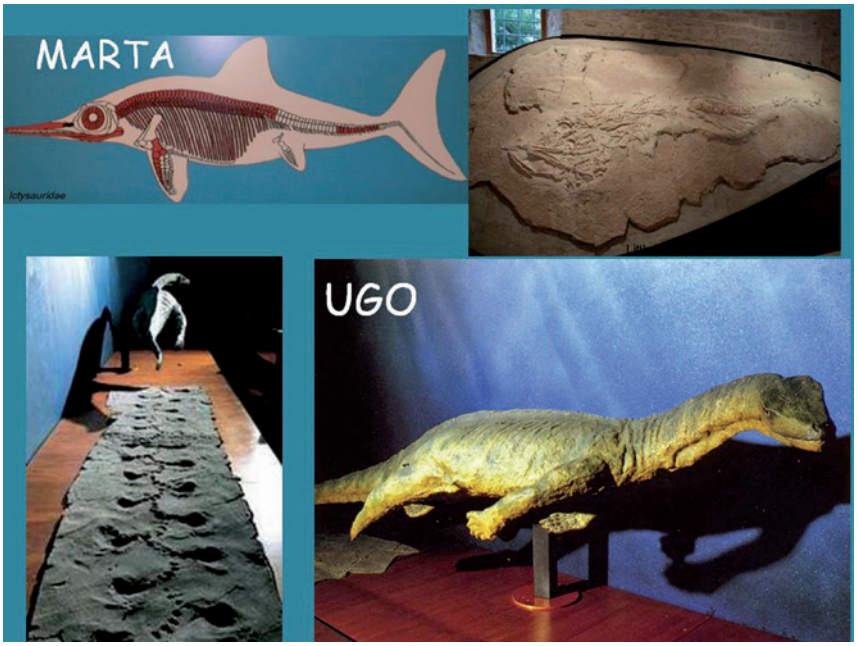

Fig. 2. Marta (Genga, Museum of Speleology, Palaeontology and Archaeology) and Ugo (Cantiano, GeoTerritorial Museum), two marine reptiles that have enabled the reconstruction of the environment in the Mesozoic Era from 250 million years ago.
Fig. 3. Specimens of Ursus spelaeus found in the Grotta del Mezzogiorno cave in Frasassi and the Grotta degli Orsi cave on Monte Nerone, whose remains are on display in the Museum of Speleology and Palaeontology of Genga and the Brancaleoni Civic Museum of Piobbico.

material that is easy to find there and important for artefacts used in a wide range of human activities, including butchering, hunting and agriculture. Flint was also the material employed in the symbol objects of new social orders. Flint or bronze daggers tell us about the first weapons of the first warriors (Pignocchi forthcoming), which were the signs of social distinction and the tokens of a new class of individuals. Such artefacts are difficult for the lay visitor to interpret, unless they are presented within the context of their era, their geographical setting and their function.

Another unique aspect linking the two areas across the ages is the realm of the sacred. This dimension is directly related to the specific features of the landscape and the context. For example, natural caves were used as places of worship in the Bronze Age (Pignocchi 2014), which is particularly evident in Frasassi Gorge (Pignocchi and Montanari forthcoming) and is paralleled in the Grotta delle Nottole caves beneath the Grotta della Fondarca cave in Monte Nerone. The extraordinary impact of these sites is not only environmental, but also emotional; they are places of worship strongly related to the awe inspired by "ritual landscapes" (Fig. 4).

These caves bore witness to the extraordinary development of complex ritual acts. They were symbolic places marking the border and connection with the underground and with the underworld, hence, between the real world and the otherworld, within an approach to the sacred still rooted in the underground. They were also meeting places between communities, playing a similar role to the one held in later days by upland sanctuaries. This is another sign of the uniqueness of these two areas, since Frasassi and Monte Nerone are the only places in Le Marche where this kind of evidence has been found.

Fig. 4. The extraordinary impact of natural caves is not only environmental, but also emotional; they are places of worship strongly related to the awe inspired by "ritual landscapes".

From the sacredness of the underground, we move to places of worship and open-air votive deposits from the 5th century BC, found in high concentration in these areas along the Apennines, the main thoroughfares, in upland areas and near water sources (Frapiccini 2014). As well as having a significance for religion and worship, these places are also the local seats of new political and cultural entities in what, at the time, was Umbrian-Picene territory.
Votive bronze figurines are found in isolation or in single deposits in open-air worship spaces in these inland areas inhabited by the agricultural-pastoral and warrior Umbrian Picenes, for whom human bronze figurines were the quintessential offering to warrior gods. Indeed, Mars figurines are found in especially high numbers between the upper valley of the River Esino, the River Metauro and the Apennines. Votive deposits were found near the River Tarugo at Isola di Fano near Fossombrone and at Coltone di Cagli, each located at either end of what was probably an ancient route going up the River Tarugo and then down again towards the River Burano. In pre-protohistoric times, this may have been an alternative to the narrow Furlo Gorge. Some attacking Mars-like war deities found at Coltone di Cagli and near the River Tarugo are closely related to the bronze figurines of Vallemontagnana and San Fortunato di Genga (Fig. 5).
The sacred theme extends to a number of Byzantine and Lombard funerary finds of the 6th and 7th century (such as combs and buckles probably from tombs from the caves at Frasassi and Acqualagna) (Pignocchi, Montanari forthcoming) in these borderlands, where *Castrum Petrosum*, now Pierosara di Genga, and *Luceolis*, near Cantiano, were extraordinary medieval defence outposts. Next, we come to the sacredness embodied in the medieval asceticism of hermitages and Benedictine and Romualdine monasteries erected in emotionally stirring

Fig. 5. Votive deposits of Mars figurines are found in especially high numbers between the upper valley of the River Esino, the River Metauro and the Apennines.

landscape settings. These include the great monasteries of San Vittore alle Chiuse, Fonte Avellana, San Vincenzo al Furlo and solitary places of retreat and worship, such as Santa Maria infra Saxa at Frasassi, Grotta San Pier Damiani cave and Madonna del Grottone hermitage between Fonte Avellana and Frontone, to name but a few. How can this extraordinary millenary story be narrated outside the rationale of individual finds or individual local museums and monuments taken out of context? We can achieve this by not merely relating the history of an object or building, but rather by creating a network of relationships with other objects and other places, within a wider local context and, above all, between small museum collections. This way, such assets will no longer be seen to represent local stories restricted to their modern geographical-administrative contexts, but rather as connected to the broader story of an area. They will have multidimensional significance, involving the geology, archaeology and spirituality of entire, stratified local contexts and will also benefit from multimedia and electronic systems intended to innovate the manner in which they are displayed and presented.
From this we come to the idea of a project involving a variety of representatives from the local public and private sectors, incentivising a more informed tourism that is aware of what is on offer culturally and environmentally. Thus, heritage assets would no longer be isolated and separate from each other. Instead, they would contain a clear, strong, continuous narrative and be part of a wider system coordinating the opportunities they bring and the way they should be used within the general system of tourist services. All this is only possible, however, if planned jointly by public and private stakeholders capable of devising system-wide governance and ensuring long-term, economically sustainable management.

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Annex I

Call for Paper

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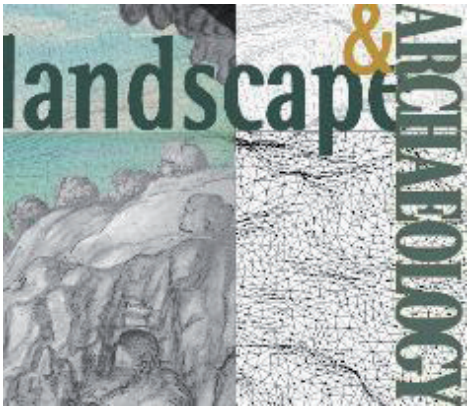

Landscape & Archaeology

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Preamble

The ancient consular route Flaminia was one of the most important connection between Rome and the towns of Fanum Fortunae and Ariminum on the Adriatic coast. The lands buffering the remnant itinerary is still today a remarkable territorial setting (i.e. archaeological remains, outstanding rural and natural landscapes, ancient and modern infrastructure and heritage). The memory of the ancient Roman Empire is still rooted in this territory, as witnessed by the rich archaeological heritage and the predominant buildings along the way. The need to foster and to maintain such outstanding common patrimony has been motivating for local politicians and public administrators to begin a series of actions highlighting its Roman past. Thanks to the engagement of the centre of Vitruvian Studies (CSV), local administrators acknowledged a joint initiative to start smart cultural and rural-environmental tourism activities. This also raises important questions concerning the revitalisation of territories and their historical heritage, on the demand for a sustainable development and maintenance, in order to strengthen the relationship between dwellers and the palaces they live.

The Uniscape En Route seminar "Landscape & archaeology" will focus on smart and sustainable initiatives in landscape & archaeology.

The “En Route international seminar” series is a tool to promote the European Landscape C both the European-wide academic community and local stakeholders (institutions, politicia and economic actors). This provides local landscape actors the opportunity to raise the que at home to a wider European context, as well as providing academics the opportunity to pre a new audience within a specific landscape context. Thus, by reaching out towards local combining the more academic activities with other thematically related events (site visits, the seminars will offer a concrete opportunity for **“awareness-raising“** (Chapter II-Article 6

Presentation

In many European countries local cultural heritage is a powerful driver for developing vario related to tourism. Management and open access to cultural heritage are challenges in enabling local communities to conserve their resources.

There are three main pre-conditions for the development of sustainable tourism of cultural

a) good knowledge of cultural heritage; b) strong awareness of local people for their prote activity; c) access to innovative and creative ICT tools to design tourism solutions with environment and a relevance for local identity.

This **Uniscape En Route** seminar will investigate how it is possible to increase cultural identit tourism in the region, thanks to the knowledge, representation and valorisation of architectu heritage and landscape, conceived in a broad sense. A main goal for the “Landscape and Arc is to share and compare positive experiences in several working fields involved in tourism, dissemination of landscape & archaeological heritage. In particular, the event will discus make the pre-conditions and their results SMART (specific, measurable, achievable, realisti

The seminars provide a forum conducive to sharing best practices (by researchers, designers experiences. **The “Landscape & archaeology” seminar will deal to the following four top**

Smart Landscape

The very concept of Smart Landscape, underlined in this initiative, is of particular intere interest of people in starting up economic activities and new enterprises linked to agricult Such a return to agriculture is marked by the need of people to express new ways of creating through new "smart" management frameworks, able to combine new technologies with the resources (landscape, biodiversity, food quality and safety). The multifunctional services p the sector (environmental, social and cultural services) represent an important opportunit areas and the new emerging contexts of peri-urban and urban fringes.

A new and interesting concept gaining ground in urban planning research concerns the “pla creative, homely and attractive city, which is able to captivate both its resources and citize of giving new meaning to its landmarks. Here great attention is paid to people, hospitality a they are the key factors in reconfiguring urban services, places and stories.

“Playable city” could appear as a counterpart to “smart city”, because the idea of creative, territory seems opposed to functional and technological aspects. Nevertheless we are deep two features should be reasonably kept together in order to trigger effective and positive cl open theme of playable city is, moreover, fits perfectly with the European Landscape Co Disseminating measures aimed at enhancing and developing smart and playable culture in o

Archaeology and digital documentation

Smart archaeology is framed in a complex of activities regarding the whole process of conse and engagement of archaeological evidence. All these aspects are closely related. In recent remains have been involved in several kinds of investigation: form preventive archaeology tc archaeology or cyberarchaeology.

The seminar will share experiences of sustainable tourism and archaeological heritage prote partnerships among several subjects involved in dissemination and safeguarding activities (research institutions, governments, sponsors, cooperatives).

A specific aim is to make archaeological science more accessible in order to improve engagement through the use of digital tools (3D model, 3D reconstruction, VR & AR experimental archaeology. These kinds of technologies are effective for researchers or non archaeological data: single artefacts, archaeological complexes or cultural archaeological la

Due to EU policies on cultural and creative industries (Green Paper on the potential of C involve the digitalization and virtualization of archaeological heritage. According to the landscape and evidences as heritage, new life can be breathed into cultural landscapes arisi and values, and contributing to the sustainability of heritage.

Smart Industrial Archaeology

Technical and productive innovation, often real deindustrialization processes, which affect societies are a key issue on local agendas (management, development, cultural heritage, e particular the sprawling Italian landscape masks a complex of different layers (p infrastructural, manufacturing plants), which are specially dense along the historical roa networks of communication. This situation is often found in rural areas, where the lack ancient cultural heritage, tradition and identity presents challenges for the policy makers careful restoration to preserve the identity of places in rural settings could provide an oppo for the renewal of a symbolic past - paper mills, kilns, mills, warehouses for goods, customs, cultural and territorial context could help to stimulate tourism and preserve important a landscape of many territories.

Heritage sustainable valorization and cultural districts

The use and re-use of cultural heritage will address the challenges of economic impact anc This kind of economic growth arose thanks to the increase in culturally-centred busi embedded within the territory and the local community. They are developing through new m devoted to the tourism experience.

The discussion over strong and weak points of the extra urban cultural districts (E-UCD), Mediterranean countries, is central to the “Landscape and archaeology” seminar. This con rural, since it contains small towns, usually important in terms of heritage and traditi countryside distinguishes itself for its valuable landscapes and traditional agricultural or fooc (DOCG, designation of origin etc.). Furthermore, in recent years E-UCDs became destinatior interested in a holiday experience that combines entertainment, culture, relaxation and als reason, the local supply has been usually developed towards tourism services and the organ

Best practices often show a public-private partnership with some SMEs engaged in techno and heritage exploitation, developing the concept of cultural districts. Using landscape anc framework, the cultural districts can be a way of overcoming the fragmentation of initiativ

labs; development of cross-border integrated strategies to manage natural and cultur revitalisation of local economies.

Participants

Scholars

Researchers

Academics

NGOs Associations

SME or start-up specialized in the I&C technologies

Public Institutions involved in Touristic activities

PhD students and students

Representatives of some projects (tourism-landscape-archaeology - ICT) developed international level

Preliminar scheduling of seminar

23rd June 2016

Arrival of participants at **FANO,** registration

Key note speech: Salvatore Settis (title TBD)

indoor seminar: first session of presentations (morning)

indoor seminar: second session of presentations (afternoon)

24th June 2016

En-route seminar along Flaminia

Exploring the archaeological sites and the landscape along the Flaminia road (morning and e Starting point Fano, end point Fermignano (around 50 km). Intermediate stops: Acqualagna Gorge and Cagli. Transport media: cycle, bus or car. Along this route, three or four stops w or four En-route sessions (seminars "en plein air") with the participation of local people, adı experts.

Conference or Round table at Fossombrone.

25th June 2016 -CAGLI

Key note speech: TDB

indoor seminar: session of presentations

early afternoon: Conclusions

Topics

T1-Smart Landscape

T1.1. Rural Tourism an opportunity to foster local economy
T1.2. Ecoservices and multifunctionality of rural landscape
T1.3. Landscape management and maintenance
T1.4. Rural Urban partnership: increasing competitiveness of rural and urban spaces
T1.5. Improving the quality of urban and rural spaces involving citizens
T1.6. New territorial instruments (ITI, CLLD; etc.) to improve attractiveness of rural and u
T1.7. Open Spaces and ICTs (geospatial technologies, Drones, Beacons, etc.)
T1.8. Monitoring of Urban, Rural and intermediate landscapes: the role of Landscape Obse
T1.9. Landscape in action: ecomuseum and participative processes

T2-Archaeology and digital documentation

T2.1. Digitization of archaeological heritage
T2.2. Remote sensing techniques in the archaeological field
T2.3. 3D reconstruction
T2.4. Point cloud analysis
T2.5. 4D modelling
T2.6. Predictive and preventive archaeology
T2.7. GIS and related databases
T2.8. Virtual archaeology
T2.9. Web archaeology
T2.10. Virtual and Augmented Reality applied to the visualization and conservation
T2.11. Monitoring and conservation of archaeological remains
T2.12. Archaeology of architecture: methods and interpretations

T3-Smart Industrial Archaeology

T3.1. Industrial landscape of historical routes and traditional roads
T3.2. Archaeology of transports and road infrastructures
T3.3. Industrial heritage and industrial location: the role of land transport
T3.4. Industrial heritage and Roman consular roads: fractures and continuity in the long a
T3.5. Contributions of the industrial heritage to the enhancement of the historic and cultu
(archaeological, artistic, religious, food, etc.)

T4-Heritage sustainable valorization and cultural districts

T4.1. Cultural districts
T4.2. Strategic actions for territorial development
T4.3. Policies and regulatory framework in archaeological exploitation
T4.4. Tangible and intangible heritage
T4.5. Valorisations of ancient routes
T4.6. Compatible re-use of archaeological sites
T4.7. GIS tools and applications
T4.8. Portals and Digital Libraries
T4.9. Mobile applications
T4.10. Remote sensing applications for cultural heritage

Publications

The Flaminia En-route seminar will accept only original, unpublished work.

All accepted papers or abstracts will be published in UNISCAPE En-route: I Quaderni, a special di Careggi.

Each accepted paper needs at least one paid registration fee.

The 10 best submitted papers will be published in the Journal **SCIRES-IT** (SCIentific RES Technology), e-ISSN 2239-4303 (http://caspur-ciberpublishing.it/index.php/scires-it).

Committee

Program committee

Paolo Clini, Andrea Galli, Ramona Quattrini

Scientific committee

Alonso Addison, Berkeley, University Of California
Fabrizio I. Apollonio, Alma Mater Studiorum-Università Di Bologna
Cristiana Bartolomei, Alma Mater Studiorum-Università Di Bologna – SCIRES-IT
Stefano Bertocci, Università Di Firenze
Carlo Bianchini, Università La Sapienza, Roma
Howard Burns, Scuola Normale Superiore di Pisa
Francesco Chiapparino, Univpm, Aipai Mual
Michela Cigola, Università di Cassino
Augusto Ciuffetti, Univpm, Aipai Italia
Paolo Clini, CSV-Univpm
Livio De Luca, CNRS, Marseille
Patricia Duff, University of Cambridge
Francesco Paolo Di Teodoro, Politecnico di Torino
Maurizio Forte, Duke University
Nicoletta Frapiccini, Museo Archeologico Nazionale di Ancona;
Marco Gaiani, Alma Mater Studiorum-Università di Bologna;
Andrea Galli, Univpm-Cirp,
Enrico Giorgi, Alma Mater Studiorum-Università di Bologna;
Pierre Gros, Università Aix En Provence, Marseille;
Eva S. Malinverni, Univpm-Cirp;
Ernesto Marcheggiani Univpm-Cirp/Kul-Ees
Antonio Monterosso Checa, University Of Cordoba
Conor Newman, National University of Ireland, Galway
Mario Pagano, Soprintendenza Archeologia delle Marche;
Juan M. Palerm, UNISCAPE
Bas Pedroli, UNISCAPE
Sofia Pescarin, CNR-ITABC, Roma
Valeria Purcaro, Università Carlo Bo, Urbino
Fabio Remondino, FBK, Trento

Organizing committee

Ramona Quattrini
Francesco Leoni
Adriana Formato
Anna Paola Pugnaloni
Laura Bertuccioli
Laura Invernizzi
Arianna Trifogli

Important dates

29th January2016 ASTRACTS DEADLINE

The "Landscape& archaeology" seminar accepts English or Italian written abstracts. Eac exceed 500 words. In the abstract will be indicated author's name and institution and gene

Send a PDF file (first-author_etal.pdf) via email to en-route@uniscape.eu

22nd April 2016 NOTIFICATION OF ABSTRACT ACCEPTATION and SELECTION POSTER/PAPER

BEST PAPERS SELECTION DURING THE SEMINAR

October 2016 QUADERNI DI CAREGGI PUBLICATION

December 2016 JOURNAL PUBLICATION

UNISCAPE En-Route a. I - n. 4 - 2016

THIS SERIES IS PART OF *I QUADERNI DI CAREGGI*
UNISCAPE'S ONLINE PUBLICATION
ISSN 2281-3195